Edinburgh Health Society.

HEALTH LECTURES

FOR THE PEOPLE.

THIRD SERIES.

DELIVERED IN EDINBURGH DURING THE WINTER OF 1882-83.

"Thou that hast *Health*, says he, and know'st not how to prize it,—I'll teach thee what it is, that thou may'st love it better."—*Mainwayring*, A.D. 1683.

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EDINBURGH
HEALTH SOCIETY.

INSTITUTED 1881.

PRESIDENT.

THE RIGHT HON. THE EARL OF ROSEBERY.

THIS SOCIETY has been formed :—

To promote, *by all means in its power*, attention to personal and domestic Cleanliness, to Comfort, Self-denial, Temperance, and the Laws of Health generally.

The means to be employed for this end may, in the opinion of the Committee, be stated in the meantime as follows :—

1. The delivery of Popular Lectures bearing on the subjects in question by Physicians and other qualified persons.
2. The printing and distribution of these Lectures, and of small Leaflets.
3. Providing subjects of Interest for the Mind, and encouraging proper Amusements and Physical Exercises.
4. Giving assistance to the Constituted Authorities in the promotion of sanitary improvements by drawing their special attention to any particular insanitary condition.
5. Obtaining the assistance, so far as necessary, of any other Society in the City willing to co-operate in the work of this Society.
6. Arranging for the *re*-delivery of the Society's Lectures in villages in the neighbourhood of Edinburgh, and for the formation in such places of small *local* Committees in connection with the Society.

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PREFACE.

THE Committee of the Edinburgh Health Society have pleasure in again issuing their annual volume of Lectures. These Lectures, delivered during the last winter to considerable audiences in Edinburgh, touch on important and varied subjects connected with Public and Domestic Health and Well-being ; and it is hoped that in their present more permanent form they may reach a still wider circle, and be the means of suggesting to very many, both in Edinburgh and elsewhere, various ways of preserving or improving the health and happiness of Domestic Life.

The Committee desire to take this opportunity of acknowledging the debt of gratitude they owe to the Lecturers, all men of high professional position in Edinburgh, for the kind and generous manner in which they have gratuitously given so much of their valuable time to the careful preparation and successful delivery of the Lectures.

The Committee would, at the same time, point out that the delivery of Lectures is not the sole object the Society has in view ; but that it exists with the larger object of endeavouring to form in this city and its neighbourhood a strong and "healthy" public opinion in favour of the

observance of the sacred Laws of Health prescribed by God and Man. The Committee are convinced that it is through the non-observance of these Laws that most of the Social Misery of our age exists, and it is with this they desire to combat. They therefore make an earnest appeal to the Public to give them practical assistance and support in their labours by joining the Society. The annual subscription is fixed at a very low rate, so that all classes may have no difficulty in associating with the Society and increasing its importance and influence.

EDINBURGH, *February* 1883.

VENTILATION.

By DOUGLAS MACLAGAN, M.D., *V.-P.*R.S.E.,
Professor of Medical Jurisprudence in the University of Edinburgh.

The duty that I have to perform here to-night differs very materially from what it would have been had I been addressing my students in the University upon the subject of ventilation. With them I would have taken for granted that they were thoroughly acquainted with a great part of what I have to say to you to-night, and I would have proceeded at once, and directly, to some of the nicer questions connected with it. But here I must take a different view. I must take it for granted that the larger proportion of those who listen to me have had no opportunity of learning any of those facts upon which the knowledge of the subject of ventilation is founded, and therefore I have to address to them a great deal of what is very simple, and very elementary. I am not going to tell you anything that is new. I am not even going to put anything that is old in a new light. But I am only going to endeavour, if possible, to mention to you one or two facts, and to offer to you one or two suggestions that may be useful to you in preserving the health of yourselves and your families.

The word ventilation may be said to mean, essentially, making use of the wind to enable us to maintain our health. That is the origin and derivation of the word expanded a little. Now, wind is, in fact, the one, I do not say the most important, but it is the one agent in producing ventilation. What is wind? Wind is the air in motion, and I use the word wind in its fullest sense. It is air in motion, no matter how

slight it may be, if it be only one of those little breaths of air that we can only feel upon our faces, grateful to us on a hot summer day, or one of those tempests that uproot trees and unroof houses. It is the same thing, differing only in degree. Wind is the air in motion.

Now, the truth is that the air is very seldom not in motion. It is exceedingly easily moved, and very slight causes produce motion in the air—not merely any mechanical agent that may make a current of air, but the slightest change in the temperature of the air may set it in motion. I am quite sure you must have observed this yourselves, as at the sea-side, for example, when there is not a breath of wind stirring, as we say, and yet when, if you look out to sea, you may see a dark line upon the surface of the water—I can hardly call it a ripple, it is so very small, but yet it is wind, the air in slow motion, perhaps only because a sunbeam has warmed the surface a little, and led to a current of air by the small change in heat.

Now, having said that the wind is air in motion, the next thing that you want to know is—What is air? If I put this question to several of my audience, I should get a variety of answers. Perhaps the first answer I should get from some one is, "Oh, the air is what we breathe." And I say "true," and it is essential that we should breathe the air, for if a man, or any other animal, no matter what, is deprived of air, death must follow in the course of a very short while. An animal will perish in little over three minutes if entirely deprived of air. Now, what is the use of air in breathing? Why do we breathe? Why do we carry on that work of breathing, of which we are not conscious when we are in health, which we carry on whether we are waking or sleeping, and which everybody knows by practical experience is essential to our continuing to live? Now, I must not be led aside from the immediate object of my lecture to-night, but I wish to point out to you why it is that we require to breathe.

It is impossible that any of the parts of our body, any of our bodily organs, can carry on their work unless they are furnished with a full and complete supply of pure blood. Now the blood,

which everybody knows is sent out, in what is called the circulation, from the heart, is, as it goes out, a bright red fluid, capable of nourishing and maintaining the body in full activity; and, unless such blood is supplied to every part of the body, it suffers at once. Perhaps I may take, as the best example, the brain, that most important and most delicate organ of our bodies. Now, the blood is sent out from the heart in this condition of a bright red fluid up to the brain, out to the arm, and down into the trunk of the body and the lower limbs; and after the blood has gone through these different textures and organs of our body, and has for the moment fulfilled its purpose of nourishing them and enabling them to perform their work, it undergoes a significant and remarkable change. Having passed through certain small vessels, and got into these vessels which we call the veins on its way back to the heart, it is now no longer a bright red fluid, but a dark, purple-coloured fluid, and it has lost something that was good for it when it was in the bright red condition, and has acquired something which is bad for it, as far as regards the nourishing of the body. It is now no longer able to maintain the organs of our body, such as the brain, in full activity, and, therefore, if we were supplied only with this our brains would not work, our muscles would not work—in fact, we could do no work at all, we should perish. We must have the blood restored back again to the condition in which it was when it went away from the heart, and, therefore, it is sent by the mechanism of the heart to the lungs, and in the lungs it comes in contact with the air which we breathe, and the blood is restored back to the condition in which it was when it started first from the heart, and is now again capable of maintaining all the parts of the body in vigour and activity. Therefore it is, you see, that it is absolutely necessary that we should be constantly breathing air, and that we should have the air in a pure state, fit for doing the good work upon our blood, and that we should have the pure air in sufficient quantity.

Now, the fact is that the burning of anything, as far as regards its effects upon the air and the effects of the air upon it, is

exactly the same as the breathing of a living animal. A candle will only burn in good air. A living animal, be it man or quadruped, can only breathe in good air. Whether it be a candle that is burning or an animal that is breathing, the air undergoes precisely the same changes, it undergoes a complete spoiling for its subsequent use. And, therefore, if it is not renewed, neither the burning of the candle nor the breathing of the animal can go on properly.

Then, perhaps another of my audience to whom I put the question—What is the air? might say to me—"Oh, the air is that which surrounds us on all sides." Quite a right answer. The whole globe is surrounded by air, what we call the atmosphere. But perhaps another of my audience, who may have had a chance of hearing a chemical lecture somewhere or other, may say—"Oh, the air is a gas." Well, that answer is so far right. It is part of the truth, but it is not the whole truth. It is not one gas, but it is a mixture of gases, and a very remarkable mixture in many respects. Let us look for a single moment at what are the general properties of the air. In the first place, when we speak of the air in ordinary conversational language, we very commonly speak of it as being exceedingly light. We talk of things being as light as air. Well, it is quite true that air is very light. If I lift up a bottle that contains air and a bottle that contains water, then, of course, everybody knows the difference in weight between the two. But you must not suppose that because the air is so very light it has not an appreciable weight. A flask, from which the air has been sucked out by an air pump, and which has been made to balance accurately with a weight at the opposite end of a balance, will descend when air is allowed to get into the flask by withdrawing the stop-cock. Now, you can very easily understand from this that there must be a very considerable amount of weight in the air, if you take into consideration the enormous atmosphere which is above us, and which according to the views of some philosophers extends to upwards of a hundred miles over our head. But take it at half that, there must be, therefore, a very considerable

amount of pressure from this great quantity of air that is above us; and, in fact, the pressure of the atmosphere amounts to about, not quite but very nearly, fifteen pounds upon every square inch. But then, of course, if it acted only straight down as a mass of iron or lead would do, everything about us would be squashed flat. But it operates in every direction, not only downwards, but sideways, and even upwards, so that if the flask had been upside down when the stop-cock was opened, the air would have rushed into it all the same, from the pressure of the atmosphere round about. Bear, then, in mind this most important fact of the atmospheric pressure, and that this pressure operates in all directions.

The next point that I have to bring under your notice is that the air swells very readily when it is heated. And if the air is made one-half bigger than it was by being heated, or twice the size it was originally, then it is perfectly clear that the mass of air must have become lighter. And therefore you must bear in mind that when air is heated it becomes much lighter. This is a most important fact to bear in mind with regard to ventilation. You will easily see the importance of this when I tell you that if, for example, we warmed the air at the other end of the hall and not at this, the pressure of the atmosphere—bearing in mind what I have just said with regard to the pressure operating in all directions—would tend in this way to force itself towards the part where the air was lighter; and, in short, would create what we all know as a draught.

Now, there is a great number of things that are explained by that. Why does the smoke ordinarily go up into your chimney instead of coming out into the room? or when you attempt to light your fire on a cold morning, why may you have the smoke coming into the room instead of going up the chimney? When the chimney is ventilating well, it is just simply this—that the air in the chimney has become warmed by the fire and is lighter than the colder air in the room, and the pressure goes towards the lighter air. But when you have the smoke coming out into the room, probably the air in the room is at first warmer than

that outside, and the pressure comes down the chimney instead of going up it. This effect is seen in the simple experiment, in which I heat one limb of a bent glass tube, with the result that the colder air rushes down the other limb and out at the warm one. Now, what you have seen me do in that very simple experiment is one of the most important things with regard to one of the most important industries of the country. That is the whole principle of the ventilation of a coal mine by means of what are called the upcast and the downcast shafts.

The next point that we have to observe with regard to the properties of air is, as already stated, that it is not a gas but a mixture of gases. In ordinary pure air, as we have it, say in a country place, because the air of towns is necessarily a greatly more impure air from the number of chimneys and so forth, there are always two gases. One of these is called oxygen, and in every hundred parts of ordinary pure air there are twenty parts of this oxygen, whilst the rest of the hundred parts are made up of eighty parts of nitrogen. Now, this oxygen is the first and most important constituent of the air. It is essential to our continuing in life, and therefore some of the older chemists called it "vital air," and a very good name it was, because that is the particular part of the atmosphere upon which we depend entirely for producing all those changes in the blood that I pointed out to you a short while ago. Now, if we set a candle burning in a limited space of air, or if we put a living animal into a limited supply of air, in a very short while—for I told you before the two were the same thing—the candle goes out, and the animal dies, or, in other words, it has been suffocated. That is because the candle, or the animal, has exhausted the amount of oxygen which was in the jar or other space. When I take a jar of pure oxygen, I show you with what brilliancy a candle burns in it.

But with regard to the nitrogen gas that remains in the jar, you see that the candle cannot burn in it. In other words, an animal cannot breathe in this. Not that the nitrogen is in itself a dangerous gas, because every one of us is drawing in quantities

of it into his chest every time that he breathes. You will ask—What is the use of the nitrogen? The answer is, that the oxygen would be too strong for us; we should burn too quickly, just like the candle, and we should perish. And therefore the use of the nitrogen in the atmospheric air is simply to dilute the oxygen and to enable us to breathe it steadily, readily, and profitably.

But there is also carbonic acid in the air, four parts in ten thousand. That is so universally diffused through the air that nowhere do we find the air without it. There is always some of it present, but in very minute quantity, as you see. Where does that carbonic acid come from? It comes from the breathing of every animal upon the surface of the globe, from everything that is burning upon the face of the globe, whether it be a small taper or a burning mountain like Etna or Vesuvius. Both in the act of burning in the case of the taper, and in the act of breathing in the case of the animal, carbonic acid is formed in quantity, and the air therefore becomes contaminated with it. And if, therefore, we have no renewal of the air; if we have not a proper supply of fresh air furnished to us for our breathing, we should go out just as the candle does in a jar containing carbonic acid. Now, you may say—"Oh, that is just our friend the nitrogen back again!" No; it is something very different, as you will see when I mix with it some clear lime water. The mixture, you see, has become quite turbid, and that is because the acid has joined with the lime to form this substance. The same effect is produced when I blow into a jar of lime water, and therefore you see that we are always pouring out a quantity of this gas from our lungs. Now, there is a marked difference between this gas and the nitrogen as regards its properties. The nitrogen has little or no properties except of a negative kind. It won't support burning or breathing, but it won't poison in itself; that is to say, it is not absolutely noxious in itself. But it is very different with the carbonic acid. This is a poisonous gas, has deleterious properties in itself, is capable, in fact, as a poison, of extinguishing life; and all of you must have heard often enough of the disastrous consequences that follow from breathing carbonic acid in very large

quantity mixed with a small quantity of air. Everybody has heard of the results of explosions in coal mines, and how, whilst a great number perished from the direct effects of fire and shock, yet a considerable number perished from what is known by the name of "after damp" or "choke damp," and among them very many of those gallant fellows—for more gallant fellows did not exist—who have perished in going down the mines and endeavouring to rescue those who had been imprisoned within. The lesson to be got from that is to take care and breathe air that is not overloaded with carbonic acid.

But there is something more given off from the lungs than carbonic acid. Moisture comes off from the lungs, and in variable quantity. Everybody knows that from breathing against a window or against a looking-glass, which is always colder than their breath. But that is not so important as what I have now to direct your attention to—namely, that we give off from our lungs also a quantity of what is called—it is a regular technical expression—organic or animal matter. What its precise nature is, we are not prepared to say; but we know something of its properties. I am not going to detain you with the proofs that we have of this fact. But you must take it from me as a fact that we regularly give off in quantity from our lungs, and partly from our skins, a matter that is of the same general nature as the matter that makes up all the textures of our bodies. But, then, it has the property that, being very thin and diffused through the air, it is very liable to undergo decomposition; in short, using the old principle of calling a spade a spade, it has a great tendency to become rotten, and it undergoes the change all the more readily because it is in the presence of moisture and warmth, the circumstances most favourable for decay and decomposition to go on. And then the matter has a nasty, unpleasant, fœtid smell, and becomes not only exceedingly unpleasant but exceedingly noxious. It has, however, one very valuable quality—it is a most reliable danger signal. If you wish to know whether the air in a sleeping-room is in a good state or not, go out into the lobby, or still better, to the outer door after your children have been an hour or two in bed

and if you perceive a "stuffy" smell be sure that there is something wrong with the ventilation.

Bear in mind, then, what are the changes that take place in the air that we breathe. The oxygen disappears, the nitrogen remains behind, the carbonic acid becomes increased enormously; the moisture is much increased, and organic matter is given out. Thus, if the air we breathe is not refreshed always, it gets an unpleasant, fœtid smell, and is noxious. These are the changes that take place in the air.

Now, the object of ventilation is to keep down these things, and to prevent their accumulation, to send back to us a supply of oxygen, and to take care that we have not such an accumulation of carbonic acid that it becomes poisonous; that we get rid of some of the moisture that is round about us, and that we get rid of the animal matter, which, as I have said, rapidly becomes unpleasant and therefore nasty and dangerous.

But you may say to me—"Well, all that you have been telling us is exceedingly curious and very interesting, but we should like to get some practical hints with regard to ventilation." Now, I will offer you a hint or two as to how to provide a little fresh air. I confine myself in what I have to say exclusively to the houses of the people of the working class. I am not giving suggestions now, either with regard to the houses of the better-class population, or with regard to public buildings, because that raises questions surrounded with many difficulties, and I have not time for it.

Supposing a working man, when it is coming towards the term time, wants to take a house, and he wants to see what he shall do to get a house that will answer for himself and his wife and his children. Bear in mind that I am not speaking here about people to whom a difference of a pound or two in the course of the year may be a comparative trifle, but I am addressing myself entirely to those who have to weigh every farthing in calculating how far their income can go in providing their homes, and the comforts of their homes. With reference to the subject of ventilation, the first thing that such a man should do is that he

should see that there is sufficient room for himself and his children.

Now, I speak more particularly with regard to the sleeping apartments, for I think this is perhaps the most important point of all to attend to. The first thing that he will ask is—"How am I to know that there is sufficient room; how many can I put into a particular room?" Now, I don't want my friend to be making elaborate calculations upon matters of this sort, but I want to let him understand, just in a general way, how it is that we make calculations of that kind, as to what is commonly called cubic space. I am assuming here that we have before us a small room of 12 feet long by 10 feet wide, and 10 feet high. The way in which we make out what is the number of cubic feet in that room is to multiply the length by the breadth, and that gives us 120, and then we multiply this again by the height, and that gives us 1200 cubic feet. Now, the smallest allowance of cubic feet for any one, either grown up or children, ought to be 300 cubic feet; and, if you divide 1200 by 300, you get 4, which is the number of people he might put into that room, certainly not more than that.

People very often say—"Oh, that would do very well as an allowance for grown-up people, but less will do for children. It is quite true that children have smaller chests and do not take in so much air at a breath as grown-up people do. But then children breathe faster, and it is of the greatest possible consequence also, that you should do them all possible justice in forming their constitutions when children. And, therefore, I do not think there should be any difference made between the allowance for grown-up people and for children. Let the children have their full allowance.

With regard to the quantity of air required for a human being, this much is known by actual experiment, that if a man be put into an air-tight box, he could not live in the box without suffering, beyond an hour. He would require 2000 cubic feet of air, supposing that no air could get in or out. But, then, of course, as we all know, our rooms are not air-tight boxes. There is a

constant getting in of air under doors, through the chinks of the windows, nay, even through the walls themselves a certain but very small current passes. Now, if we close up every opening into our room as to make it as like the air-tight box as possible, then in a very short while you are just in the position of the man locked up in the box—the air has become so vitiated by your breathing that it is impossible to continue in the limited supply of air without suffering in health. In order to obviate this, there must be some means of letting fresh air in. But that will be of little use, and it would not come in at all, unless there is also a means of letting the foul air out. And, therefore, there must be both a means of outgoing and a means of incoming for the air.

Now, we know very well that in a great number of work-rooms and so forth, the air is exceedingly bad. In the rooms of seamstresses, and the compositors' rooms in many printing offices, the air is exceedingly bad, because there is not only the breathing of human beings, but the burning of a great quantity of gas required for the business. Until recently little or no attention was paid to such questions. But improvement has come with the attention now paid to public health, and I hope such lectures as are given here will have some effect upon this and similar questions. But it very often happens that the fault is not on the part of those to whom the premises belong, but on the part of those obstinate work-people who, because they feel the slightest amount of cold air getting in about them, think that they are going to be killed outright by it, and immediately shut up the holes. Now, if they suffer in their health, it is in that case their own fault.

The object of ventilating a place is to let in the air without causing a current to come in so rapidly as to produce what is commonly called an unpleasant draught. The air should come in very slowly. It has been estimated that it should not move at a greater rate than one or two feet a second, or from 60 to 120 feet in a minute.

What are the means of ventilating in a sleeping room, or in a

room that we are inhabiting? One of the most important means of ventilating rooms is the fire-place. You have already seen how it does that. But it is of great consequence, not only that fresh air should get into a room, and foul air out, but that it should be diffused through the room, so as to renew, as much as possible, the whole air of the room. The fresh air, as a general rule, should not come in at the floor alone. When it comes in there alone, particularly in cold weather, it very soon chills the feet. It is of great consequence that it should enter the room above the level of the heads of those who are in it. With regard to public buildings and so forth, many contrivances are had recourse to for the purpose, but I am not going to enter upon them.

But one of the most important things for you to attend to is to look to the windows, and above all things, to see whether the window opens from the top or not. It is of the greatest consequence that you should be able to pull down the window from the top, and let in fresh air and the foul air out, and to see that the window can be got down from the top easily. But a landlord would say to my friend who is asking him to do this—"Oh, it is an expensive business, and if I am to make all these windows open from the top, I must raise your rent." Well, he would not be beaten even in those circumstances. Here is a little model to illustrate what I mean. Here the upper sash is fixed. Put a piece of board, which can be got for about a sixpence, at the bottom of the open lower sash, and the air will come in above, between the two sashes, and will ascend, and no unpleasant draught will come in to blow things about, or chill the good wife at her work, but the air will spread itself out in every direction, and the whole of the room get benefited by it.

Take care, also, especially with regard to the sleeping rooms—and this is a most important thing—that the beds are not placed in such nooks and crannies that the fresh air cannot get at them in any way. Common sense will guide you in every particular room. But there is one abomination against which I wish to protest most strongly, and that is the plan of putting up beds in

a closet, which may be all very well for stowing away groceries and putting lumber into, but not human beings. When you object to that, some people say—"Oh, but the door is always kept open, and they get the benefit of the air in the room!" But they don't get the benefit of the air in the room, because there is no door or opening in the back of the closet to enable them to get the benefit of it. And, if this is bad for the children who sleep there in health, fancy what it must be if by any chance the children are taken ill with disease. See that the beds are placed where not only air, but daylight can reach them. Daylight is not only essential to cleanliness, but it has a most valuable chemical power of destroying the animal matter, such as comes off from our lungs, and which so readily becomes fœtid. I beg of you never to allow a bed to be put up in a closet or place of that kind, unless there is a fair way passing through it, by which the air can get and pass through it.

Perhaps some of you may say—"That which was told us to-night really applies very well to the house we have been living in for a while. But after all our bairns are wonderfully healthy, and they don't seem to suffer from it very particularly." Are you quite sure of that? Let me tell you what may happen, and what most assuredly does happen very often.

We shall suppose that our friend has a boy at school about nine or ten years old. I suppose that the parent is one of those who wish his children to enjoy a good education, and does not require to be hunted up by School Board inspectors. He is sure that Johnnie is an active, sprightly boy, but after a while it is observed that he wakens sometimes in the morning complaining of a headache, perhaps not very much after all. But he does not take his breakfast very well. That is a very bad sign of Johnnie, and when he goes to school, the school-master sees, and the parent hears with vexation that he is not getting on somehow or other very well; that he is listless and indifferent, and does not say his lessons well. And then they think that that is the fault of the boy, because in the afternoon, when he and his friends are out in the playground nobody runs about more briskly

and no one yells more loudly than Johnnie. But what is the truth? The child has been sleeping all night, I shall say, in one of these airless closets, perhaps some other of the family sleeping with him. He wakens up in the morning with his blood full of this carbonic acid and decomposing organic matter coming off from his lungs. He gets up with his blood half poisoned, and, as you have seen, his brain cannot work unless it is supplied with good blood; and it is not supplied with good blood when it is contaminated with these foul things. But if the school is only fairly ventilated—and every school should be well ventilated—he gets rid of a good deal of this foul matter in the course of the day; and when he gets out into the playground and there gets the fresh air of heaven, he gets rid of all the foul matter rapidly, and then he becomes the brisk and lively boy that he ought to be. Perhaps you blame him, or you may have thought of punishing him. I hope you don't, because punishment is the stupidest way to try to make a boy learn his lessons. The blame does not lie upon Johnnie but upon somebody else, and I leave you to say who that person is.

But something more serious may happen from want of proper attention to ventilation. Your children, we shall suppose, begin to grow up and come to early manhood, or specially let us say, early womanhood; and the daughter of the house, who has hitherto looked well in every way, begins to get a little thin and loses her appetite. After a while you hear her cough once or twice. You suppose she has a slight cold and it will pass away, and you don't pay much attention. But it continues, and she gets ill and grows thinner, and you take her to a doctor. And the doctor says to you, if he is a straightforward, honest man—"Your girl is threatened with consumption!" You say indignantly—"That cannot be, because both I and my husband are strong and healthy, and belong to perfectly healthy families." Well, that may be quite true. Nothing can be truer than that consumption may be inherited, unless it be that consumption may be acquired. And that is what is the case. The whole system of the girl has become lowered, and she takes a little cold. Remember what my

friend Dr Affleck told you last year about taking a cold; it may lay the foundation for that most serious of diseases, consumption, from the effects of want of ventilation.

It may be said, perhaps, that I am raising a bogie in all this, and endeavouring to frighten you. Let me give you evidence that I am not exaggerating. About the year 1856 much attention was directed towards the enormous prevalence of consumption in our army, more especially among the troops known as the household brigade, quartered chiefly in London and its neighbourhood, and there came out the remarkable fact that out of every hundred deaths in those troops about sixty-seven were due to consumption. Now, what was the class of people among whom this occurred? Fine stalwart fellows that had been picked up as recruits, and every one, before being enlisted, examined to see that, at the time at all events, they had nothing wrong with their lungs or anything else. They were not men who were under-fed or ill-clothed. But they were housed in barracks that had not sufficient cubic space, and where not sufficient attention was paid to ventilation, and so consumption occurred in this enormous quantity, which has been immensely diminished since attention was bestowed upon the important subject. We should not forget that much of this improvement was due to a noble-minded man, Lord Herbert of Lea, better known by the name of Sydney Herbert. The same thing has taken place in an infinitely worse degree in the armies of nations upon the continent, but they have been roused up a little and begin to see that the best way of keeping a soldier in good health is to take care that he has plenty of cubic space in his barracks, and plenty of fresh air.

Let me conclude with a single practical observation. I beg of you not to go away from this lecture, or any of these health lectures, carrying with you a sense of the importance of the subject discussed, and thinking that, because you may have bestowed attention as far as you can upon that, therefore you have done your full duty to your families and yourselves. Bear in mind that attending to one thing will not constitute proper at-

tention to health. You may supply the best ventilation that can be to your children, but if you don't feed and clothe your children properly, you are only doing a third of your duty to them. Remember the importance of what Dr Jamieson said to you about keeping the skin acting healthily and cleanly, and bear in mind the importance of good wholesome food for your children. Therefore take care that by no foolish expenditure, still more of course by no vicious expenditure of your means, do you cripple yourselves in your resources so as to be unable to furnish, along with good air, good clothing and good feeding. Don't take one of these health lectures, but take them all with you, and take out of them as much as you possibly can, and try and wind them together, and thus you will be enabled to do your duty properly to yourselves and to your children. I am quite sure there is no one here that will think I am irreverent when I use the words of Him who spake as never man spake, and say—"These ought ye to have done, and not to leave the other undone."

PHYSICAL EXERCISE: ITS FUNCTION.

By CHARLES W. CATHCART, M.B., F.R.C.S.

Ladies and Gentlemen,—I am sure you will not think that because the subject on which I have the honour of addressing you this evening has come in the third series of Saturday evening lectures, whose special title is "Health," it is on that account of less importance than any of the others which have preceded it. Nay, rather, it seems to show the wisdom with which the order of these lectures has been arranged, that a subject of such great importance has been kept back till some of those primary branches of Human Physiology have been explained on which its proper understanding depends. Recalling to your recollection for a moment some of those to which I refer, there was first the introductory lecture impressing on you the importance and duty of taking care of the body, or in other words, of cultivating the physical side of our nature, not only as a duty in itself, but also as bearing in the most important way on the health and well-being of our mental and moral nature as well. Then there followed lectures explaining the general structure and functions of the bones and muscles, of the circulation of the blood, of the method and means of respiration, of the structure and uses of the skin, of the nervous system, and of food and its digestion, while last Saturday Professor Maclagan explained to you some of the great principles of ventilation; and now in some ways we may look upon our present subject as supplementing these, depending on them for its proper understanding, and in turn showing how they all hang together, and how they are all in their way neces-

sary for the highest possible condition of health. But when I say health, I may be using a word which perhaps may not be understood by every one in the same sense as I myself use it. I will therefore ask you to allow me to quote the definition of "Hygiene" as given by the late Professor Parkes in his manual on that subject. "It is," he says, "the art of preserving health, that is, of obtaining the most perfect action of body and mind during as long a period as possible consistent with the laws of life. In other words, it aims at rendering growth more perfect, decay less rapid, life more vigorous, death more remote." Our task to-night then will be to see how physical exercises affect the various vital functions of our frame, and to ascertain if, and how far, they contribute to render "our growth more perfect, and our life more vigorous," and, as a part of the same process, "our decay less rapid, and death more remote."

Now, before we begin to consider the subject of physical exercise itself, it may not be amiss if we glance at a great principle or law which seems to pervade the whole universe of life, so far as we know it, whether of plants or animals. It is that for the proper maintenance of health, there must be a constant alternation of activity and rest, the one following after and preparing for the other. We see it in the seasons summer and winter, in the succession of night and day, light and darkness. A plant that gets its rest in the dark, and that is called into activity by the sunlight, would soon fade if kept constantly in the dark, or would show a sickly over-growth if it were supplied with artificial light, so as to make a never-ending day. Ward, as quoted by Hilton in his excellent work on "Rest and Pain," points out that "Plants in hot countries have their period of rest in the dry season. In Egypt, the blue water-lily obtains rest in a curious way. This plant abounds in several of the canals at Alexandria, which at certain seasons become dry; and the beds of these canals, which quickly become burnt as hard as bricks by the action of the sun, are then used as carriage roads. When the water is again admitted, the plant resumes its growth with redoubled vigour." Thus in some climates the rest is given by

the scorching heat of summer, in others by the bleak cold of winter; but the principle is the same in all, and the types of activity and rest which the seasons and night and day give us for the world at large are true for all the forms of life within it, in whatever way the principle may be carried out for each. It is, moreover, familiar to us all if we would only think of it. We know that if we labour all day, sleep will assert itself at night. None of us could hold even his arm out for ten minutes at a time without tiring of the continuous strain, and it is so well known as to "stand to reason" that if a man is always thinking, his brain will give way, and he will turn mad, or if he is constantly eating, his stomach will suffer, and he will have serious indigestion. This great principle of life we may take with us then as we go, that it is as true for our minds and bodies as for the plants, and as true for all the microscopic particles which make up our bodies as for the bodies themselves, that a regular succession of activity and rest must be provided, if they are to be in a natural condition and lead a healthy life. We shall have occasion to refer to this great principle; but meanwhile let us leave it for the present, hoping that its great truth is recognized, and let us pass now to the consideration of that form of exercise which is specially defined as physical.

Exercise, I need hardly say, means action, practice, or use; and since physical is applied specially to our bodies here, and since the movements of our body, of whatever sort, imply contraction of muscles and movements of bones, we may define physical exercise as "the action and use of our bones and muscles." It is a fact which, though mentioned in passing by Dr Cunningham, may well bear repeating here, that no movement in the body, however slight, can take place without the contraction of muscles or muscular fibres, and accordingly it will be a fitting introduction to our subject if we spend a little time at the outset in looking at some general points as to the contraction of muscles, and as to the mode of their arrangement. After that we can pass to the effects of muscular exercise on respiration, on circulation, on the nervous system, and on the development and vigour of the body

generally; and we will then be in a position to consider some short rules which may guide us in the carrying out of physical exercise and in the selection of its various forms; while, lastly, we shall make a few general deductions from the knowledge we have thus gained, leaving it to some future occasion to enter more fully into the subject from a practical point of view.

To begin with muscles, we find them to be the agents in our body for movements of all sorts, and to enable them to fulfil this end they are endowed with the great characteristic of contraction or alteration of their form in a particular way. If you watch a common earthworm crawling along the ground you will notice that it lengthens its body out, becoming thinner at the same time, and from having first fastened its tail against the ground, it thus pushes its head forward; then, fixing its head against the ground it shortens its body again, and draws its tail up to its body, while as it does this you will notice that its body becomes thicker again. In this way the whole body can be seen to undergo alternate changes in its shape, at one time thin and elongated, at another time shorter and thicker. In other words, the animal has shown itself to have the power of forcibly altering its shape in a particular way to fulfil a definite end. All through the process it must be remembered that the bulk of the worm was the same; it was only its form which underwent change, but at the same time, if the worm had been large enough we might have felt that its body became harder and firmer the shorter it was, *i.e.*, the more it was contracted. Now before we leave our worm, let me ask you to notice another point, and that is, that the effort to shorten was the same at both ends of the worm; and the reason why the head moved at one time and the tail at another, was that the moving end was for the time being the less fixed, while the other was by certain means, which we need not inquire into here, rendered the more immoveable and fixed of the two; the fixed and the moveable end were made to alternate with each other, and thus the animal was able to progress steadily in a certain given direction. Now the changes which you see in the worm, which is a hollow muscle, are in all essential particulars similar

to those which take place in the muscles of our body; and if the above simple facts are clearly borne in mind, you may feel that you have grasped many of the most important points in the contraction of muscle which bear strongly on what we will have afterwards to consider.

Looking on muscle, then, as having this great capacity of contraction, I must remind you that all that which we usually call flesh is nothing else than this muscular fibre. What we eat in animals is almost invariably simply their muscle, whether it be a sirloin of beef, the breast of a chicken, a slice of salmon, or the claw of a lobster. But this mass of muscular tissue is not found in an indefinite heap, as one at first might be apt to suppose, for a careful examination will show that the whole is composed of separate layers and subdivisions, which can be separated distinctly from one another into what are called individual muscles. If you look at a ham which has been cut, in a grocer's window, you will see the red flesh intersected with white lines or streaks—these are the lines indicating for the most part the separation of the muscles from one another; and in the next leg of mutton that you eat please notice that the slices are divided into separate portions or muscles, each often with its own particular kind of flesh. Now, if instead of this rough method of examination, we make a careful dissection of the muscular mass of the body, we will find it arranged into about 400 separate muscles of various sizes and of different shapes. Some are broad and flat, some rounded and cylindrical, but all have this character in common, that while the muscular tissues constitute the active or fleshy part there is an arrangement at each end for fixing the muscle to the part on which it is intended to act. This fixing apparatus is in the form of cords or bands of shining fibrous tissue, and makes what we call the tendons or leaders of the muscles. We may leave out for the present the muscles which move the face, and are thus attached at one end to the skin, and may take those which are fixed at both ends to the bones, as being the more numerous and most important to us at present. These leaders, then, pass from the muscles to the bones, and we find that the

bones are roughened and thrown into ridges at the points of their attachment. This is important, as it shows a tendency for the bone to grow out where the greatest strain is put upon it; and it has thus been found that the growth of bone goes on side by side with that of muscle, thus indicating a relation between the two which at first might not have been supposed. It is so well known, however, to those who have studied anatomy that they can tell at once, from the general appearance of any two bones, what the development of the muscles attached to them has been; and they could pick out one as that of a powerful, brawny man, and another as that of an individual poor and feeble.

But we must not suppose that the muscle itself is simply a large mass of contractile tissue; on the contrary, as we can judge from the grain in a slice of beef, it is subdivided again and again into smaller portions by processes of fibrous tissue which pass into the interior from the outside sheath. The smaller pieces become so small that we are obliged to the microscope in order to discern what we may call the elements of our muscular man. These elements are thus found to consist of delicate fibres or threads, of muscular tissue about $\frac{1}{2}$ an inch long, and averaging about $\frac{1}{100}$th inch in breadth, and composing when grouped together in various ways the different forms of muscle which we have already indicated.

This muscular tissue arranged so complexly constitutes a large proportion of the bulk of the body, and I must remind you of the great service which its contraction afford us. Not only are all our voluntary movements produced in this way, including the sounds which I am sending out from my throat at present, but all the vital processes depending on movement, and which are beyond the control of the will, such as the pumping of the blood by the heart, and the movements of the stomach and intestines in digestion—all these are in like manner dependent on muscular contraction.

But it may be asked, can all the subtle tracings of an artist's pencil, the tender shades of expression of a human face, be produced by these muscles, which pull only in straight lines? Yes, they can be, and they are; and that leads us to the next point

viz., the forces which cause them to contract. No muscle can contract unless stimulated or excited by a nervous impulse coming from the brain or spinal cord, and accordingly we find that every muscle has its corresponding nerve, which conveys the orders to it from the brain, and without which it must remain unchanged. This nervous impulse is not electricity, but it is something like it, and it may serve to illustrate how the nerve impulse produces a contraction of the muscles if I stimulate the muscles of my own arm with this small battery. As soon as the electric current passes through them you will see that they start into contraction and pull up the fingers. The process is similar when the nerves produce the stimulation, only they have the power of acting on one or many muscles, or on parts of them, in the most beautifully delicate manner possible. Now, the nervous impulse is just as important as the muscle itself, and thus it is that if the connection along the nervous line be injured at any point, or if the activity of the brain be in any way impaired, as by a blow on the head, or by alcohol in excess, a corresponding damage is at once produced in the power of the muscle, however good or healthy its fibres may be at the time.

And now we are in a position to understand why there are so many different and distinct muscles in the body. Each has its own particular action, according to the joints over which it passes, and the part of the bone to which it is attached; and it is by the delicate interposition of one muscle, or part of a muscle, with another that we get all that marvellous variety and delicacy of movement with which we are all familiar, and which is technically called co-ordination. No muscle ever contracts by itself; there may be one or two muscles which have most to do with a particular action, but many other muscles in distant parts of the body must contract along with it, and help it to produce its special result. For instance, if I raise my arm up and hold it fully out from my side, not only are the muscles passing from the shoulder blade to the arm bone contracting, but in addition those fixing the shoulder blade itself to the trunk; and now I must in turn contract some of the muscles of the trunk,

and involuntarily alter the grip of my legs on the floor to meet the unsteadiness which the extended arm tends to produce on my previously well balanced body. Now, although in the simple illustration which I have taken, the necessary contraction of distant muscles was produced, not only without my being aware of it, but also without effort, it was not so the first time I tried it, for each new combination requires practice to enable us to train the other muscles to come in at the proper time and in the proper order. This practical result of co-ordination is called knack, and as its regulation depends on the proper succession of nervous impulses, it shews us another particular in which the nervous system is of the greatest importance to the proper and efficient contraction of the muscles. In passing let us learn a lesson from some of these theoretical considerations. We can see that the exercise of one part of the body indirectly tells upon many others which we would not suspect. Hence the value of vigorous walking, for instance, with the swing of the arms, the balance of the body, and the action of the legs, but hence also the danger of movements which are one-sided and often repeated producing the constant and associated action of certain groups of muscles which may produce changes in the bones and alterations in form which no one would suspect, because apparently not concerned immediately in the movements in question. Who would imagine, for instance, that when you write a letter quietly at a table you require not only muscles in your hand and forearm, but also in your upper arm and shoulder as well; this, however, is an important fact and should not be forgotten, because some of our practical rules for exercise will depend upon it. Another point as to muscular contraction before we leave it, and that is as to the blood supply of muscle. Every contraction uses up so much material derived from the food which acts as fuel, and is, as it were, burnt up in the muscle. The blood parts with its nutrient material which is stored up within the muscular fibre during the period of rest, then when the nerve stimulus comes, the stored material is broken up again, oxygen is absorbed from the blood, and certain waste products, especially carbonic acid gas, are dis-

charged into it, so that it has to be purified in the lungs and kidneys before it is again fit for use. Thus a contracting muscle which in virtue of its life required *some* blood before, requires not only more blood to give it new material and to carry off its waste products, but it requires also leisure and rest to build up new fuel for future contractions. Mr Gaskell of Cambridge has seen under the microscope that the arteries going to a muscle and the veins coming from it are much distended with blood during its contraction, and thus we see how the demand is fully met by the supply; and, as to the requisite for leisure, we all of us know that the greatest trial is an even steady strain, since nothing is more tiring than a continuous cramped position, much more so than a more violent but intermittent effort. All these apparently dry details on the changes going on in muscle during contraction and the resulting alteration in the blood, the increased quantity of blood passing through exercised muscle, and the requisite for alternation in muscular contraction, have an important bearing on physical science as we shall afterwards see, so I must ask you to note them carefully now. At the same time, too, I may point out that similar conditions hold good for all the other tissues of the body in their condition of vital activity, whether it be the brain in thought or mental excitement, or the various glands such as the liver and kidneys, all requiring and using more blood during the period of their activity, and calling for times of leisure to build up new material against a repetition of the same.

Before leaving the subject of muscles and their contraction, let me remind you briefly of what we have seen, viz., that muscles are the agents for all the movements of our body, and this in the larger movements by acting on the bones; that the growth of bones goes on with that of muscles; that muscles are very numerous, have nerves communicating with the brain running into them, and can be made to associate with each other in what is called co-ordination; that besides nerve stimulus they require a large blood supply, the character of which is altered as it passes through the contracting muscle. These latter will much help us

as we pass now to consider the effects of muscular exercise on the various functions of the body.

Let us take first of all *the changes in the respiration during muscular exercise.* We are all familiar enough with the fact that exercise not only makes our heart beat quicker, but causes us to breathe more rapidly and fully at the same time, while the amount of carbonic acid and watery vapour exhaled are much increased. These phenomena have been carefully examined by experiment, and accurate results can be given. In the first place, as to the amount of air expired, Dr Edward Smith has prepared a table showing the relative amounts of air breathed under varying amounts of exercise; taking the lying position as unity, it runs as follows:—

Lying position,	1·
Sitting,	1·18
Standing,	1·33
Walking 1 mile per hour,	1· 9
„ 2 miles „	2·76
„ 3 „ „	3·22
„ 3 „ „ and carrying 34 lbs.	3· 5
„ 3 „ „ „ 62 lbs.	3·84
„ 3 „ „ „ 118 lbs.	4·75
„ 4 „ „	5·
„ 6 „ „	7·

and a few more which need not be given here.

Or, as Dr Parkes puts it, "Under ordinary circumstances a man draws in 480 cubic inches per minute; if he walks 4 miles an hour he draws in (480 × 5 =) 2400 cubic inches; if 6 miles an hour (480 × 7 =) 3360 cubic inches."

But it has been found also that the amount of carbonic acid exhaled during exercise is much increased, and although for a time after the exertion is over the amount as during rest is somewhat below the average, still the total amount is increased, as will be seen from the following table prepared by Messrs Pettenkofer and Voit. I may mention that work here means enough

labour to give moderate fatigue, while rest means quiet occupation with the fingers :—

	Average Elimination of Carbonic Acid in Grains.		Average Absorption of Oxygen in Grains.	
	Day.	Night.	Day.	Night.
Rest, . .	8825·25	6100·73	5771·56	7062·60
Work, .	13217·50	5447·49	8410·44	6720·63
Work Day, .	+4392·25	−653·24	+2638·88	−341·97

These figures no doubt look dry and uninteresting, but we may now associate what is thus proved to take place in the air which is breathed with what is found to happen in the blood circulating through a muscle during its contraction. The muscle uses more oxygen and gives out more carbonic acid, consequently a greater demand is made on the lungs. More air is required, and the blood must be driven the faster through them, and this accounts for the shortness of breath and beating of the heart which we all know by experience to accompany any muscular exertion.

If we reflect on these carefully ascertained facts it will be clear that in cases where the lungs are in danger of suffering from insufficient expansion, and where carbonic acid is thus apt to accumulate in them, and the circulation of the blood to be impaired, great benefit will result from active exertion, more especially if it is such as to call into play the muscles of the shoulder and chest. This is now so well recognised by medical men that the systematic practice of full and deep breathing and the regular exercise of the chest muscles is considered an important element in the treatment of those with weak lungs, or who are already in the early stages of consumption. But surely if this is so well known it becomes every reasonable person in charge of the young to see to it that no such important preventive measure has been neglected as that afforded by healthy, free, and natural exercise. But again, if we look at the demands made upon the air while a person is taking exercise, we will see how very important it is that the air should be not only large in amount, but also exceedingly pure in quality. Let us take as an

example what generally takes place at an ordinary dancing party. A room is filled with people, certainly more than the number which, in ordinary circumstances, it was intended for, or what science would allow, supposing they were all to continue at rest. Presently dance music is played, and the whole company exert themselves violently, certainly as much as would be equal to walking at the rate of four miles an hour. And what is the consequence? Not only do they now require five times as much air as they did before, but they are using up the oxygen and giving out the carbonic acid at a relatively much increased proportion, while people are afraid to open the windows in case of draughts. This is bad enough in itself, but when we remember that this condition of affairs is often carried on so as to encroach on many hours of the time for needful rest, and almost always in a blaze of gaslight, every burner of which, as Dr Wilson told us last year, uses as much air as four or five men, we can see that those entertainments require serious attention and careful management if they are to be conducted on sound principles of health, as I must say I think they might be. Last Saturday we had the advantage of hearing Professor Maclagan on the subject of ventilation; let me impress on you the increased necessity of it when active exercise is being taken.

The late George Henry Lewes in his "Physiology of Common Life," draws attention to the experiments of Herbst, which show that "the same man who when naked was capable of inspiring 196 cubic inches at a breath, could only inspire 130 when dressed," and the late Dr Parkes, in his work on Hygiene, points out as deduction from this and the above physiological facts, that during exercise, whether directly involving the use of the shoulders or not, the lungs should have the freest possible play; therefore there should be no tightly contracting garments round the chest which would interfere with its expansion, and thus tend to neutralise the very benefit it is destined to bestow; and it follows further from this, that where exercise has to be taken in such ill-designed garments, the amount of work done must be in proportion diminished. Dr Parkes having pointed out that the clothing and

accoutrements for a soldier should be made as loose and free as possible over the chest, goes on to say: "And yet till a very recent date (and in our service unfortunately even now) the modern armies of Europe were dressed and accoutred in a fashion which took from the soldier, in a great degree, that power of exertion for which, and for which alone, he is selected and trained." This was written in 1864, let me give you an example from the late Egyptian war. I have received it from good authority, and it will show the importance of the subject, and give you one illustration of the effects of eighteen years longer continuance of custom *versus* humanity and sense. A body of soldiers and a body of sailors had to make a march of three miles in the scorching sun on two consecutive days, and over the same ground. They were both able-bodied healthy men under orders for the war; the soldiers had their tight-fitting jackets, the sailors their loose and free costume. Before the march was ended no less than 130 of the soldiers had fallen out, while every single man of the blue jackets continued in his place. I know of no other difference between the two sets of men, and whether the costume had anything to do with it or not, after all that we have seen I must leave you to judge.

Effect of physical exercise on the circulation.—The heart's beat becomes more rapid and stronger at first, but if the exercise be too violent and prolonged, or if begun too suddenly, then the beats become feeble and rapid, and afterwards feeble and irregular. We thus see that, by physical exercise, within certain limits the blood will be circulated more efficiently and rapidly all over the body, and a healthy glow is, as we all know, produced in the skin. The latter is thus enabled to throw off much watery vapour as well as urea and salts, and so relieve the kidneys of a duty which would otherwise fall to their share. It is plain, at the same time, that unwonted excessive strain must act injuriously on the heart, hence the importance of beginning gradually and systematically any exercise which involves unusual exertion, and as a proof of this physicians find that the greatest number of strained hearts come to them soon after the beginning

of the summer holiday, before the heart is accustomed to the increased exercise. We reserve for those of really weak heart only its milder forms. But in case of misunderstanding, let me point out that some hearts are weak from not having had enough work to do, and the best treatment for these would be systematic and regular exercise, slight at first but gradually increased.

Effects of physical exercise on the nervous system.—I need not appeal to you now for the reasonableness of relaxation and rest to the brain, if it is to fulfil its functions as the organ of thought clearly and well, but I may yet dwell on the different ways in which relaxation may be afforded. To a certain extent, and within certain limits, mental rest is given by change of subject, but after a time then comes the necessity for a relaxation still more complete and thorough, and I would impress on you strongly that for this purpose nothing can take the place of active physical exercise when one feels tired and listless after a spell of close and continuous mental work, there is no better remedy than some active and interesting muscular exertion, which will make the lungs expand freely, the heart beat strongly, and the skin glow and break out into a full and free perspiration. We hear it sometimes said that brain and muscle cannot be developed at the same time, but this is from looking at the question from a narrow and one-sided point of view. It *is* true that many athletes have been and are dull at books, and that many intellectual men have had feeble and ill-developed bodies, but it is not true that there is any necessary connection between weak brains and strong bodies, or between strong brains and weak bodies.

The ancient Athenians have never been equalled for intellectual culture, and yet they made exercise and development of the body one of their first and chief cares, and the perfection of their men and women, as handed down to us in their statues, has been a subject of endless wonder even to the present day. Those who contrast mental and physical culture to the detriment of the latter, forget that the brain, which is the organ of the mind, requires pure and healthy blood as well as any other organ in the body, and if we can find any agent which will strengthen the heart and

expand the lungs while it gives the needed relaxation to the brain, surely it requires no further recommendation from me as one to be encouraged and upheld. But if any one should wish direct proof on the subject, I can refer him to the investigations by Dr Morgan on the oarsmen of Oxford and Cambridge, where the history of each member of the University for ten years was carefully traced, and it was found with reference to class honours that not only was the average of the rowers as good or better than that of any equal number of men taken promiscuously, but that many of them stood in the highest ranks in the Classical and Mathematical Tripos.

Looking at it from another point of view, I may refer to the intelligence and ability of the working classes as a proof that hard and constant physical labour in no way tends to depreciate the quality and strength of brain power—nay, rather, it seems to foster it, for it is out of their ranks that many of our greatest geniuses have sprung in almost every department of intellectual life. As Scotsmen, I need only mention such names to you as Burns, Hugh Miller, James Watt, Sir James Simpson, and Thomas Carlyle, as a proof that the working class has been the stock from which many of our best brains have been bred.

I might easily dwell longer on this part of our subject, but our time is limited, and I must now take up the effects of exercise on the bones and muscles, and on the tone and vigour of the body generally. It is one of the most beautiful principles in our bodily structure that the supply and demand are made to adapt themselves to one another in equal proportions. When a muscle is exercised there is waste of tissue, but it receives more blood and grows stronger, and is thus better able to do the work required of it, while when its use is no longer required it loses bulk and firmness, and becomes less fit for the same work as before. The arm of a blacksmith is rugged and strong—as Tennyson puts it—

> "And arms on which the standing muscle sloped,
> As slopes a wild brook o'er a little stone,
> Running too vehemently to break upon it,"

while a clerk's is rounded and soft; but if the clerk were to turn

blacksmith, and the blacksmith clerk, the aspect and condition of their arms would to a considerable extent be reversed. Now, please note that I say to a *considerable* extent, and not altogether, for this really carries with it one of the great advantages of physical exercise to young people, and it is this, that when the person is young the exercise he takes, or omits to take, will put a stamp upon his frame which he will carry with him to his grave. If, while the bones are soft and growing, the muscles are acting freely so as to open the chest and set up the frame work of his limbs, these good results will remain, although in later life the exercise should be discontinued; and if, on the other hand, while the body is still in that plastic condition, it should be allowed to grow up cramped and undeveloped, no amount of exercise when he is grown up will ever make full amends for this early and unfortunate neglect. On the results of exercise on the chest I am fortunately able to give you precise information. When Mr M'Laren, of the Oxford Gymnasium, took his first batch of twelve non-commissioned officers to train them as gymnastic instructors for the army, he took careful measurements of their chest girth and muscular development, and noted the result from time to time. I need not give details, but the general result let me give you in his own words. "The muscular additions to the arms and shoulders, and the expansion of the chest were so great, as to have absolutely a ludicrous and embarrassing result, for before the fourth month several of the men could not get into their uniform jackets and tunics without assistance, and when they got them on, they could not get them to meet by a hand's breadth. In a month more they could not get into them at all, and new clothing had to be procured, pending the arrival of which, the men had to go to and from the Gymnasium in their great coats. One of these men had gained five inches in actual girth of chest." Now what did all this mean? Not merely growth of bone and muscle, but surely a deeper and wider chest, the lungs so much bigger, the blood so much purer and bringing, accordingly, so much the more vigour and tone to the whole body. To use Mr M'Laren's own words

again, there was "the change in bodily activity, dexterity, presence of mind, and endurance of fatigue; a change a hundredfold more impressive than anything the tape measure or the weighing machine can ever reveal."

To take another example. I have in my eye a certain school where physical exercises have for many years been systematically and thoroughly carried out. The circumferences of the chests have been carefully taken by a trained army instructor (1) of every new boy, (2) of every boy in the school at given intervals, and the results have been tabulated at the same ages. I shew them to you here, and you will see that taking the new boys as those who have previously not had exercise (although some had which unduly raises the average), the improvement by regular exercise as indicated by the table of those at the same age, but who have been at least three months at school, is very marked and striking.

	Aged 14.		Aged 15.		Aged 16.		Aged 17.	
	No.	Avge.	No.	Avge.	No.	Avge.	No.	Avge.
New Boys, .	51	29·3	35	30.6	16	32	6	32·5
Former Boys,	209	30·6	261	32·1	212	34·2	148	35·8
Increase, .	...	1.3 in.	...	1·5 in.	..	2·2 in.	...	3·3 in.

But some one may turn round and say, This is all very well in its way, but what about the intellectual training? And my answer is, if you mean real intellectual training, it is so much the better for this healthy and vigorous frame; but brain power is a different thing from ability to stand well in competitive examinations. The two *may* go together, but often they do not, and many a promising youth at college or at school has fallen in after life into commonplace mediocrity or premature decay from want of that even balance and energy of mind and body which a little systematic exercising in his early days would have given him. If you want better authority than mine, let me quoto to you from Dr Beddoe, in his paper "On the Stature and Bulk of Man in the

British Isles." He says, "If we examine only a single race or reputed race at a time, we shall find that whenever that race attains its maximum of physical development it rises highest in energy and moral vigour." And to illustrate this he refers to "Scotland in general, to Northumberland, Cumberland, parts of Yorkshire, and Cornwall, as the portions of evidence which produce the finest and largest men;" and adds, "that it will be acknowledged that they also yield more than their share of ability and energy for the national benefit." I cannot dwell longer on this part of our subject, though more evidence might easily be brought to bear on it; but I think I have said enough as to the effects of physical exercise on the vital function of the body to justify what I will now lay down as a proposition, that *physical exercise is of the greatest importance to mankind throughout life, and in young and growing people its value is simply beyond calculation.*

Let us now rapidly consider some rules for the regulation of physical exercise.

1. It should be conducted in an abundance of fresh air, and in costumes allowing free play to the lungs, and of a material which will absorb the moisture, and which, therefore, should be afterwards changed—flannel.

2. There should always be a pleasant variety in the exercise, and an active mental stimulus, to give interest at the same time.

3. The exercises should, as far as possible, involve all parts of the body and both sides equally.

4. When severe in character the exercises should be begun gradually and pursued systematically, leaving off at first as soon as fatigue is felt; and when any real delicacy exists, the exercise should be regulated under medical advice.

5. For young people the times of physical and mental work should alternate, and for the former the best part of the day should be selected.

6. Active exertion should be neither immediately before nor immediately after a full meal.

Had time permitted I might have said something about each of the rules, but I must content myself with merely enumerating them just now, as it has been my intention in the present lecture to make clear the general principles which underlie all physical exercise without trying to explain their practical application. I have taken this course specially because one is struck in every-day life by the want of sound knowledge on this subject. Most people are eontent to think that physical exercise is mere "play," to be indulged in occasionally, but not systematically, and that it is not by any means a necessary part of young people's education. I can quite fancy some good people here to-night saying, "why make all this ado about physical exercise, we had no regular gymnastics, no athletic or football elubs, yet here we are well and strong still. Why should not the young people nowadays do as we and our fathers did?" Now, supposing some one has said this, as is more than likely, I will try to give you my answer as shortly as I can. I must then, to begin with, remind you that in every particular we are living at a much higher pressure now than we were even at the beginning of the present century; the rapid introduction of steam and electricity has, so to speak, eon-centrated our country, and in fact the eivilized world, four or five times over; the population in our little island has increased enormously in the last fifty years, and the competition for all means of livelihood has increased at a similar rate. Thus a striving to excel one another has been a marked feature of our life, imposing on all a mental strain which our quieter forefathers knew nothing of. Then the population in the towns has been increasing out of all proportion to that of the country, thus raising entirely new aspects of our problems of social life. In older times when the towns were smaller, and business and professional life less exacting, it was easier to find time and opportunity to get out into the country and counteract the influences of the confine-ment of the town, and the strong, fresh population from the country was constantly infusing new blood into the towns. Listen, again, to what Dr Russel told us last year—"In Scotland, during the last ten years, the larger towns increased 37·37 per

cent. in population, while the mainland rural districts only increased 2·81 per cent.; and the population of the insular rural —the healthiest districts of all—actually diminished in number by 1·3 per cent." Again, in speaking of England and Wales, and after showing the increase of the town population over that of the country, he concludes by saying—"So that this year the number of dwellers in towns is almost exactly double the number of dwellers in the country." These facts are certainly striking, to say the least of it, but they are more than striking if we read them in the light of Dr Russel's further observations, for he goes on to say—"Now, if there is one fact more than another which the Registrars-General both in England and Scotland delight to din into our ears, and to illustrate and prove in every report, it is that, just as the density of the population increases, so does the death rate—that, in fact, the nearer people live to each other the shorter their lives are." Here, then, are the facts: our country population is rapidly decreasing because deer forests and larger farms are turning the smaller holders out, and steam and mechanical apparatus are taking the place of the farm servant; the population of the towns which brings with it a higher death rate, is multiplying exceedingly fast, and the strain of mental worry is much greater than ever, while it begins earlier and lasts longer in life. How are we to prevent the race from degenerating? Well, Professor Maclagan pointed out that we must not use one means without the other—fresh air, good food, pure water, and now I add one more, healthy exercise, which will help us to have sound hearts, healthy lungs, and clear brains. Do weigh well what I have tried to explain, and if I shall have succeeded in showing you the great importance of the subject, I will consider that the first step has been taken towards the introduction of and provision for physical exercise among us just as much as for any other branch of education.

THE ESTABLISHMENT AND MAINTENANCE OF BRAIN HEALTH.

By J. BATTY TUKE, M.D., F.R.C.P., F.R.S.E.

Last year I started on the assumption that my audience would be practically ignorant of the structure and anatomical arrangements of the brain; and I accordingly set myself to demonstrate to you certain leading facts connected with its conformation. As I walked home after that lecture was delivered I asked myself the question what good is all that you have said and shown to-night likely to effect? The answer came slowly, and its tenor was very much as follows:—"The knowledge of the public of that great organ, to the disease of which you have been for years directing your attention, is necessarily slight, and if you have conveyed to the hundreds who listened to you so patiently and with so much apparent interest the knowledge that it has a definite anatomy, that it is not a mere mass of white stuff shut up somewhere in the skull, that it has the most important relations to the whole system, if you have given them some reasons for believing that it is the great dominant organ of the body, some good has been done. It is not to be expected that they will have carried away with them all the details, but if you have conveyed the general impression that the arrangement of the brain is as definite as that of the heart and lungs, your audience will be all the better prepared next year to accept your statements as to how the laws of health can influence it." Believe me, I was not and am not, underrating your intelligence. I was

then and am now merely oppressed by the vastness and endless ramifications of the subject, by my own feeling of incapacity to convey to you adequately some little of what is known, and by doubts as to whether I am choosing those portions of this intricate matter which will be of real practical usefulness.

I take it for granted that you have read last year's lecture before coming here to-night, and will therefore only occupy your time for a very few minutes in recapitulating a few of the leading anatomical and physiological facts. I ask you to bear in mind that the *cells of the grey matter are the essential, active elements of the brain*, and that they possess the vital property of generating, receiving, and transmitting nervous influences. As to the generation of nervous influence, I will only quote the words of Hermann :—"In the brain cells certain material processes are accompanied in an inexplicable manner with wholly indefinable phenomena, which characterise what we term consciousness. The term mind may be applied to the combination of all the actual and possible states of consciousness." What these material processes are, we do not know ; but that the phenomena of mind cannot be manifested without a material medium, and that this medium is afforded by the cells is amply proved by physiological experiment and by the observation of disease. As to their receptive function, you will remember that I gave you certain definite data for believing that these cells are the organs of sensation, that through them we see, hear, smell, taste, and feel ; further, that by the constant education of experience, impressions are stored up in them, and that this storing of impressions we term memory. And as to the transmitting function, you were shown that the stimulus of what we call the Will was inoperative if the cells were destroyed, or if the nervous communication between them and the body was interrupted. There is yet one function to be mentioned. We have good reasons for believing that the cells exercise an influence over the nutrition of the general system, and that when they are imperfect from birth, or become subsequently the subjects of disease, the health of the body is concomitantly affected. I am speaking in very general terms, but I think suf-

ficiently definitely for the purpose of this lecture. Although of late years many great strides have been made in working out the anatomy and physiology of the brain, it must be freely admitted that there are yet great gaps in our knowledge; for instance we do not know whether one cell can receive *and* generate, or generate *and* transmit, or whether one cell receives and passes on the impulse to another. But as I told you last year the general tendency of research is towards the localisation of function in particular parts of the brain. We have, however, to do to-night with what we do know; and I hold it to be a well-ascertained physiological fact that the brain cells are organs which can be acted on for good or for evil, and that they are directly subject to the laws of health. This we will keep before us as a primary proposition.

I am inclined to think that in the mind of the public a greater degree of mystery hangs about brain disease than about any other form of ailment, more especially when it is accompanied by imperfection or aberration of mind. The cause of this is not far to seek—it is the result of the misconception that it is the mind not the brain that is diseased. It is only of late years that it has been thoroughly acknowledged even by the medical profession that such affections are really the result of diseased action in the brain. There is no stronger evidence of the extent of this misconception than can be gained by examination of a book termed "the Nomenclature of Diseases, drawn up by a joint-committee of the Royal College of Physicians of London," and issued in 1869 by the authority of the Registrar-general to each member of the medical profession in order to assist in naming diseases for the purpose of registration. In this work there will be found a list of some nine hundred diseases, a large assortment of poisons, and fifty-seven pages of accidents and malformations under which the body of the Briton is authorised to suffer or die; the mind of the Briton is authorised to suffer from only six "disorders of the intellect;" the idea of bodily disease as associated with mental aberration being studiously ignored. On what principle the differentiation between a disease and a disorder is

founded, it is difficult to say; still there the opinion stands, expressed by very high authority, that Insanity is not a disease of the body, that it is merely a disorder of the intellect. With this fact before us, how can it be wondered at that the public throws a sort of metaphysical glamour over the whole subject, and takes it out of the category of ordinary disease. All this mystery which hangs over nervous disease veiled from the sight of the public that the brain was as much subject to the laws of health as the lungs, stomach, or heart, and induced it to regard many manifestations of its disease as a mysterious dispensation of providence, differing essentially in kind from the thousand and one ills that flesh is heir to.

Turning to the title of this lecture, "The Establishment and Maintenance of Brain Health," I find I have set myself a text on which I might preach for a month, a text which might involve consideration of the most intricate and difficult social questions. It is not difficult to see that in point of fact every question of sociology bears directly on brain health. I am thankful to say that I am not a candidate for the representation of your city, a position, which I may say in parenthesis, is not one conducive to the maintenance of brain health, and I can therefore dispense with discussing such great imperial questions as national education and the liquor laws, improvement of dwellings, and public health regulations, except so far as we are individually concerned.

It may be just said in passing that as a nation we have decided to adopt a system of education which is in itself the greatest brain tonic at our command, a remedy which if not altogether a specific, must strike deeply at one great cause of crime, misery, and degradation. We have decided that every child must be educated up to a certain point. Living as we do in comparative comfort, we are apt to forget in the noble words of Dickens, when speaking of the state of London some forty-five years ago, "How few they are who tenant the stately houses, and how many those who lie in noisome pens, or rise each day and lay them down at night, and live and die father and son, mother and child, race upon race, and generation upon generation, without a home to shelter them

or the energies of one single man directed to their aid—how in seeking, not a luxurious and splendid life, but the bare means of the most wretched and inadequate subsistence, there are women and children in this one town, divided into classes, numbered and estimated as regularly as the noble families and folks of great degree, and reared from infancy to drive most criminal and dreadful trades—how ignorance is punished and never taught—how jail doors gape and gallows loom for thousands urged towards them by circumstances darkly curtaining their very cradle's heads, and but for which they might earn their honest bread and live in peace—how many die in soul and have no chance of life—how many who could scarcely go astray, be they vicious as they would, turn haughtily from the crushed and stricken wretch who could scarce do otherwise, and who would be a greater wonder had he or she done well, than even they had they done ill" (*Nicholas Nickleby*). The Education Act must gradually blur the outline and deaden the colour of this Hogarthian word picture, the fearful and vivid accuracy of which there are many amongst us too well cognisant of. Especially in our great cities, there is a considerable class, the members of which may be termed *moral idiots*. Let me explain this term. We are all pretty well acquainted with the term idiot as applied to a person in whom the intellectual faculties have not been developed. The word "idiot" means a deprived person—deprived of the power of intellectual development. There is a class of intellectual idiots whose idiocy is the result of deprivation of certain special senses; a child who cannot see and hear may be prevented from attaining average intellectual development from the impossibility of carrying to his brain impressions from without. In somewhat like manner we may have people deprived of the power of developing the moral sense. A child brought up, or, rather, dragged up, in a cellar; whose parents are thieves by profession, whose companions are equally degraded, who is surrounded from his earliest days by scenes of debauchery and wickedness, must almost inevitably fail to develop a moral sense. Right is wrong to him, and wrong is right. Strictly speaking,

this is his moral sense. And yet to this degraded creature the law is applied with equal force as to the man of ordinary education. This is, perhaps, a cruel necessity of society for the repression of crime; but it may be fairly hoped that the necessity will lessen day by day as education reaches this lowest stratum of society. As the work of the Education Act goes on, so must the moral idiot become less frequent, and the fearful responsibility of society in punishing the untaught become less and less. Some of us may feel at times inclined to grumble at the expense and working of the Act; but the grumble will cease if we reflect that we, as a nation, are doing our very best to remove a serious opprobrium from society. The Compulsory Education Act is something like the Compulsory Vaccination Act. Society has determined in the one case to apply a preventive to the spread of a serious and dangerous bodily disease, and in the latter to a great and serious moral disease. In neither case may we be entirely successful, but in both we are doing our best to apply the principles of preventive medicine.

And, as a community, we in Edinburgh may congratulate ourselves that we have done, and are doing, our best to clear our city of the noisome dens in which the residuum of society is born and bred. We have cleared away many of the old closes and wynds which were the nests of habitual crime and debauchery. Crime and debauchery can never be thoroughly rooted out, but the action of our municipal authorities goes far to remedy a very important evil, it is gradually preventing or lessening the possibility of the honest artisan and his family living in their neighbourhood. There is no more hopeful sign of the general improvement of our community than those great rows of workmen's houses, which we see starting up in all the suburbs of our beautiful city—not, I admit, adding much to its physical beauty, but affording the means to a great end—giving fresh air and healthy houses to a great and important section of the community, and preventing contamination with moral filth. We have much to thank our municipal authorities for in their action in this matter. Great fears were expressed when the Improvement Act was first put in force that the workman would suffer great inconvenience. In

the working out of all great reforms, cases of individual hardship must arise. I believe such are found in the working of the Factory Acts, the Education Acts, and others adopted for the general good; but, mind you, the general good always comes back on the individual, and, after the first friction is overcome, there is a general feeling of wonder that the old state of things had been permitted to persist so long.

But, putting aside such great measures which have so much to do with the establishment of public health, we will now narrow the question. In speaking of the influences which act for good or evil on the brain, I feel inclined to divide them sharply into two classes. First, those over which the individual has no control; and, second, those over which every man and woman can exercise control. In discussing the first class of influences it will be necessary for me to touch upon certain rather delicate points; but I conceive it to be my duty to do so, as I find them constantly cropping up in daily practice: and, although as regards certain of them, advice may not materially influence action, still I consider it the business of a Health Lecturer to warn, in hope of guiding. The influences over which the individual has no control are those connected with his antecedents and upbringing. A man may be handicapped in life by the mistakes or faults of his ancestors; and, different from the race-horse, he has to carry weight in the race of life according to his imperfections, not according to his advantages.

There is a pretty general consensus of opinion that consanguineous marriages are, on the whole, to be deprecated. It is a matter of general observation, that the people living on or near the border dividing two countries are marked by strong physique, which observation supports the theory that the less closely man and wife are connected in race the greater probability there is of their offspring being healthy. Attacking the question from the other end, there is sufficient evidence adducible that consanguinity of parents tends towards degeneration of race. When we turn to the lower animals constant instances present themselves, and the fact is generally acknowledged by stock-farmers. As regards the human race,

the general outcome of the investigation appears to be that the offspring of healthy cousins of a healthy stock is not more liable to degeneration than that of unrelated parents; but that where there is a family history of constitutional disease of any kind, there is a strong tendency in the children of cousins to degeneration. The objection to the marriage of blood relations does not rise from the bare fact of their relationship, but has its ground in the fear of their having similar vitiations in their constitution which in their children are prone to become intensified. If we task our memories, and try to remember how many perfectly healthy families we have known—families without a history of consumption, gout, rheumatism, affections of the nervous system, &c.—I fear the number we can estimate will be very small; and if we take into account the tendency of such diseases to become intensified in the children of cousins, I think you will agree with me that consanguineous marriage involves a risk which it is not well to incur. Looking back on my own experience, I have very rarely met with an instance in which the children of cousins were in physical or mental condition up to the level of their parents; and I have known many instances in which there was a very well marked falling off, or an intensification of family disease. I think it is in conformity with the experience of most physicians that the nervous system is the one most liable to suffer; and when we take into account the multiform functions of the nervous system, it may be almost assumed that it, of all the systems, is the one most likely to suffer first. This is a complex subject, and I will not press it further. I will only reiterate that the children of cousins are handicapped by a greater liability to disease than the offspring of unrelated parents, and that such marriages are, as a rule, not to be encouraged.

There is one other delicate point I must touch on. I am often asked by anxious parents whether it is advisable to allow their children to marry into families in which nervous disease is known to exist. Of course, as an abstract proposition, there is but one answer to this question—that it is not advisable; but in this work-a-day world it is not often that we can base our action on

abstract principles. In the first place, the public is apt to take nervous disease in the lump, especially insanity. Time will not suffice to-night to explain in detail what I mean by this expression; but I will adduce one or two examples which will illustrate its general drift. The father or mother of a family may become insane far on in life as a consequence of senile decay, or may receive accidental injuries to the head producing mental aberration, or may suffer rupture of a blood-vessel in the brain, and become demented as a consequence of the apoplexy. In all these three cases it may be required to send the subjects to an asylum where they may die. This is enough with a large section of the community to suggest the idea that there is "insanity in the family." A minute's reflection, however, will show that in such instances there is no real blot in the family history, and that there is no more reason for anticipating nervous instability in their children than in a family in which such an incident has not occurred. This type of case excludes a large section of cases from the consideration whether it is advisable to marry into a family in which insanity has cropped up. Again, the term insanity is a generic one, comprehending a large number of various diseases; there are insanities *and* insanities, many of which experience tells us are much less liable to be transmitted than others; so that it is not a mere matter of madness that has to be considered as existing in a family, but which of the many forms comprised in that general term has made its appearance. But even if we admit the existence of nervous disease in a family, are we to say that its members are to be debarred from marriage? I for one say no. There are many other forms of disease which are almost if not quite as transmissible as affections of the nervous system. I have already instanced cancer, consumption, and gout; and if every man or woman is to be debarred from marriage because his family history is not intact, one department of the Registrar-General's returns would seriously suffer. It is quite a different matter if the man or woman has been the subject of such disease; but it has been very rarely my duty, and then under very exceptional circumstances, to advise that proceedings should be stayed where the family

antecedents are not all that could be desired. Even in the cases of previously affected individuals, the circumstances should be most carefully weighed before an adverse opinion is given. Mind you I am not advocating marriage under such conditions—I only wish to express an opinion that there is not much more, if any more, reason for avoiding a family in which there is a history of nervous instability than there is of avoiding families in which other forms of hereditary disease exist.

We may now pass from these more remote points, and consider the practical questions connected with the rearing of the infant and child. Every child's future history depends on the food it gets, and on its surroundings. I remember my much revered and beloved master, the late Professor Syme, used to say, that if you were to take a healthy child born in a palace, and rear it in a cellar in the Cowgate, you would produce a degenerate man, and *vice versa*, if you were to take an infant born in the cellar, and place it in the palace, a well-developed human animal would be the result. This, I believe, to be in the main true. Much depends on the mother; if healthy, she should suckle her child, but not for too long. I have met with many cases in which the sole ascertainable cause of nervous symptoms in young children, was their being too long suckled. This is a far too frequent source of infantile convulsions and other spasmodic affections, which may continue to affect the nervous system throughout life. But the mother herself must be well fed; and this brings me to a question which I should like to discuss in some little detail. In some respects, I believe, the food of the working-classes in Scotland is improved; partly because wages are higher, partly because in the new workman's houses the means of cooking are better, and partly because new articles of diet have been introduced into the market. But I also believe that it has become deteriorated by the disuse of a very important item, porridge and milk, for which has become substituted a much less nutritious and in itself somewhat deleterious article of diet—tea and bread. Need I go back on history to remind you how the Scot in days gone by worked and fought on meal alone—how, with the meal bag by

his side, he marched over the Border and made it very uncomfortable for my countrymen in the north of England; or need I remind you that up to a very recent date, and even in some parts of the country at the present time, the Scottish ploughman worked and works his day's darg on porridge and milk for breakfast, milk and porridge for dinner, and porridge and milk for supper? You probably all remember the story of the retort of the Scotsman (Lord Elibank, if I remember right) who was twitted with Dr Johnson's definition of oats, that it is a grain given in Scotland to men, and in England to horses; "true," said he, "and where will you find finer men and finer horses?" The physiologist will tell you that porridge and milk is a "typical" food, *i.e.*, that it contains all the necessary constituents of food in the most perfect proportions. Now, I appeal to such of you as are forty years of age and upwards, whether, in your own experience, the use of this most excellent and delicious food has not diminished, and the use of tea and toast greatly increased. Now, of course, I have nothing to say against the staff of life, so long as it is sound in quality and well baked, except that it is not such a typical food-stuff as oatmeal, and, weight for weight, does not possess an equal power of nutrition as porridge. Moreover, manufactured bread is not over all of such uniform good quality as raw oatmeal; more especially in our manufacturing towns it is frequently made from inferior flour, and inferior bread can be made to carry a good deal more water than the first-class article. Again, if eaten too new it is indigestible, and if too old it becomes tasteless or sour. But it is the constant use of tea which I would most strongly deprecate. It is an old saying in Scotland that strong tea is "bad for the nerves," and this is certainly true. I daresay you remember Dean Ramsay's story of the Highlander to whom it was remarked that whisky was a very bad thing, "Ay," said he, "whusky is a very bad thing, especcially bad whusky," and so with tea, bad tea is a very bad thing. The teapot constantly by the side of the fire "masking" a decoction containing, not only the useful parts of tea, but also its really deleterious constituents, is a frequent cause of dyspepsia. Tea is a very good

thing when properly prepared and sparingly used; but even then it takes the place of milk, the most perfect arrangement of food stuffs, and in so doing stands in the way of more thorough alimentation. I hope my teetotal friends will not be very angry with me if I say that it is quite open to argument whether the teapot or the whisky bottle exercises the more baneful effects on the public constitution. I don't think the question has ever been fairly worked out.

In the highest court of the Church of Rome when it is proposed to canonize a person of reputed sanctity, an ecclesiastic is specially appointed to contend against the claims advanced, who receives the designation of *Advocatus Diaboli*, or devil's advocate. I have often felt inclined to assume this thankless office as regards tea when I hear it asserted that it should take a high position among food stuffs. My main contention would be, not that it is absolutely bad in itself, but that it tends to exclude from the dietary of Scotland what has been for centuries the great national dish, and that by the substitution of an inferior diet, and the exclusion of the superior one, the general physical character of the nation must in time become deteriorated. But I would go even further and say, that imperfect nutrition, and the dyspeptic conditions which tea is apt to produce, tend towards the consumption of whisky, and therefore that the abuse of the teapot acts perniciously in two directions. This part, however, I am not going to play to-night, and will merely confine myself to advising all working men, whether they work in the workshop, in the office, or in the study, to feed themselves, their wives, and their children at least once a day on the most perfect form of food which God has given them—porridge and milk.

I am thankful to say that in Scotland there is slight cause for entering a protest against the baneful practice which obtains to a dreadful extent in the manufacturing towns of England, of administering sedatives to infants. There, under the name of "quietness," "soothing syrup," etc., opium is sold, which the hard working mother has got into the habit of thinking she is justified in giving to her child in order to allow her going about her daily work. I merely mention it here in order that should

any of you meet with the practice you may be able to tell the offender that she is sowing the seeds of direst disaster.

In the building up of the constitution of the child, too much importance is attached by many to the use of butcher meat, in fact there is a too great tendency at present on the part of people of all ages to excess in this direction—certainly with children, solid meat should be sparingly used; it is a direct stimulant applied at an age when stimulation is not needed. It would afford subject for an interesting little Roundabout Paper to consider how far the excessive athleticism of the present day is the outcome of an over stimulating diet administered to our youth. This, however, cannot be followed out on the present occasion, and I find the time is so fast slipping away, that I must omit a great deal I was anxious to lay before you as regards the effects of dietary on the establishment of brain health.

The next subject which naturally suggests itself as exercising an important influence on the child's brain cells, is education. As regards this, my remarks will be in the direction of what to avoid rather than what should be done, and this in a somewhat fragmentary manner. In this city of Edinburgh, philanthropy has taken the direction of providing institutions for the education of orphans and of the children of poor people—noble and great institutions which have doubtless effected much good where their function has been exercised for their proper objects. But it is more than doubtful whether they exercise a beneficial influence; if they in any instance take a child from its home and the Board School. I hold that a man must be very poor indeed to be justified in giving up the care of his child; and that he who can maintain even a very moderately comfortable home, outrages the laws of society and of health in debarring his child from its educational influence. Home is home be it ever so humble, and a charitable institution can never be home, however comfortable. To send a child away from the family influence into an atmosphere of necessarily strict discipline and routine should be the last resource of misfortune. The life of a child so placed is artificial, its individuality is endangered, and its experiences circumscribed.

With every respect for the management of these institutions, I would much rather see a child of mine less well dressed, less well fed, living early into real life, his brain cells absorbing real experiences and becoming educated by normal vicissitudes, than see him the best boy in the best hospital. I am speaking as a physician and a physiologist when I advise you to avoid the temptation, should it be presented to you, of sending your children to any institution, when by any sacrifice you can keep them at home. Of course a child has to encounter greater dangers at home than when shut up in a monastic institution; and I will very shortly review one or two of these dangers. Not the least serious accrues from the ambition of parents desirous of seeing their children taking a forward place in their classes. With me it is not a matter of everyday experience that children are overworked or overwork themselves at school. I freely admit that cases of overstrain do present themselves, and further that overstrain is much more common amongst girls than amongst boys. One of the great causes of overstrain in early youth is the vicious system of offering prizes for competition. I believe school prizes to be an utter mistake. Of course the argument is that they stimulate a spirit of emulation; but is a spirit of emulation the proper spirit in which a boy or girl should work, or is the constant pitting of one individual against another the proper direction in which a school-master should labour? I know as a fact that many of our most eminent teachers deprecate the system of prizes, and adhere to it simply because it pleases parents. It deflects the mind of the child from the main aim and object of its study, and often defeats the object which it is hoped to obtain. A boy or girl labours to acquire a certain amount of abstract facts, these are stored up, but in such a manner as to bear little or no relation the one to the other. We hear many ridiculous stories about the results of the examination of children so educated, or I should rather say crammed. I will give you an instance. I have it direct from a Cambridge examiner that the following answers were given to certain questions set at the examination of a Ladies' High School in England:—

Question 1. How many kinds of triangles are there? *Answer.* There are three kinds of triangles—first, the equilateral triangle, which has three sides; second, the quadrilateral triangle, which has four sides; and third, triangles with many sides: these are termed polyglot.—*Question* 2. State all that you know about Nathanael. *Answer.* Not much is known for certain about Nathanael. What is absolutely certain is that he was *almost, if not quite,* the same as Bartholomew.—*Question* 3. What is faith? *Answer.* Faith is believing what you *know* is not true. I can easily understand how such ridiculous results came about. Facts, names, and theories had been shovelled into the brains of these poor girls, and dropped out under the pressure of the circumstances of examination as disjointed as when they went in. And mind you, ludicrous as they were, I strongly suspect that they were not much more so than what are daily experienced by examiners. The youthful mind must not be pressed too far in the direction of abstract facts and theories. Our whole educational system is running somewhat wild in this direction, and the child's brain does not get time to assimilate the food it gets. A sort of brain dyspepsia or indigestion sets in, of which the story I have just told you illustrates the symptoms. My experience may be exceptional, but it tends towards the opinion that the rising generation is not so well acquainted with the standard literature of our own country as boys and girls were twenty-five or thirty years ago. I daresay its knowledge of the hard facts of history is more exact, the rules of arithmetic may be more thoroughly understood, but I doubt very much whether "Robinson Crusoe," the poems of Burns, the "Pilgrim's Progress," Walter Scott's glorious novels in prose and verse, Prescott's "Conquest of Mexico and Peru," and such like educational influences are as much at work as they used to be. In this age of competitive examination there is no time for the study of books which have no direct bearing on an examination paper. It appears to me that we are rearing an educational tree which is apparently strong in the stem, but which is sadly deficient in foliage and in flower; and be it remembered the leaves of a tree are its lungs,

without which it cannot be thoroughly nourished, and without which it will soon become a hard, dry stick. Children are too apt to seek relief from work in the mass of trashy literature which emanates daily from the press. In this there is no real relief; it is a mere frittering away of time, and keeps the child from becoming acquainted with the really softening influences of literature, and gaining unconsciously an insight into the workings of the minds of men whose works have done much to mould national character. Careful reading of such standard books as I have mentioned helps the boy's or girl's brain to assimilate the tougher food it receives at school, and introduces a digestive power which helps to diffuse the aliment throughout the whole mental system.

And here I cannot refrain from asking the question, do our teachers administer intellectual aliment as carefully and as thoughtfully as might be? Is there not a strong tendency to administer strong meat to babes, and, moreover, too many varieties of strong meat? I think it will be freely admitted that the scientific study of education is but in its infancy, and that in our system of education many relics of the past still exert their influence. It seems to be taken for granted that all children are alike, and that every brain is prepared to digest the same food. Further, is it sufficiently taken into account not only *what* to teach, but *when* to teach? As there is difference in the periods of development of the bodies of children, so there is difference in the periods of mental development. The present system seems to work fairly well for clever or precocious boys and girls. In most instances precocity is mistaken for cleverness. But mind you there is a pretty considerable contingent of the childish population afforded by stupid boys and girls—probably not stupid in themselves, only stupid in that they are not able to receive and assimilate mental food presented to them at a particular period. With this class I have a very great sympathy, in that they suffer in order that the more precocious of their fellows should be pushed forward. It is only natural that the teacher should prefer the latter and neglect the former. Nor is it entirely his fault

that he does do so, for under existing circumstances school is so pitted against school, so much of a teacher's success depends on the pushing forward of his pupils, that he can hardly help himself. Is there not some degree of truth in the statement that now-a-days the pupil is being made for the school, not the school for the pupil? If it is so, the establishment of brain health suffers.

A great deal has been said and written of late about the overworking of girls and young women in schools and colleges, and my friend Dr Clouston has come forward as the champion of health and ignorance for woman. I cannot help thinking that he has over stated the position of matters, that he has based his opinions more on the observation of isolated cases than on the general condition of highly educated women, that he has mistaken the wail of the one for the murmur of the many. No doubt a certain number of young women suffer and break down *whilst studying;* but this does not necessarily imply that study is the cause of the break down. Is it certain that their systems would not have given way had they been employed in offices or shops or even in domestic service? We doctors often see young girls coming up from the country to domestic service, who are well fed and well cared for, and who notwithstanding from some inherent weakness of constitution suffer from the very same train of symptoms as the young woman who applies herself to study. And even although a certain proportion of young women do suffer from study, is that a reason why the majority of the sex should be debarred from the benefits of higher education? Looking at the question from an evolutional point of view, may we not almost assume that, at the outset of a new departure, a few must suffer? The wide spread higher education of women is a new departure; custom and fashion have shut women off from its prosecution for centuries. If we accept to any extent the theory of evolution we must conclude that the organ which has been neglected for so long may suffer when stress is suddenly put on it; but we may also assume that a very few generations will evolve a power of reception and assimilation in the brain of

the female sex which will render the number of sufferers fewer and fewer. However that may be, I am certain of one thing, and that is, that idleness and ignorance are much more prolific causes of disease amongst women than overwork. They are the main producers of hysteria and of all sorts of vapourish complaints, of many ills and evils to which I cannot here do more than allude, and of inanity if not of insanity. As a matter of fact it is not an easy thing to overtask the energies of the brain by work. It is not work but worry that kills the brain: the latter I fear must be ever with us all. The most highly educated and hard working women whom I have the honour of knowing are eminently healthy; perhaps this may be "the survival of the fittest;" but even granting that it is so—the more women work, the more fit women we will have. One great complaint against woman is that her sense of justice is imperfect—how can it be otherwise if she is debarred from acquiring trained habits of thought? I hold it is better for coming generations that woman should have her brain steadied and strengthened in early life by real study and real work, and that it is not well to rear girls in the idea that marriage is the aim and object of their existence. The time has gone by when the theory is tenable that woman should be regarded or regard herself as a physiological apparatus. This is being practically acknowledged by society, and the force of public opinion is opening up new fields for female labour. It is to be hoped that the field will be even further widened, and that women will drive men out of many occupations in which their physical strength is misapplied, and compel men to seek for work in such manly occupation as is afforded by the army and navy. We may over-run the scent a little at first, and girls may become too ambitious for office work, and despise that most healthy and honourable work, domestic service. But there is little fear but that in this, as in other matters, the labour market will gradually procure accommodation.

But, as I have said, break-down from overstrain does occasionally take place, and I wish very shortly to tell you what the very earliest symptoms are. It is quite possible that the outward

appearance of fair bodily health may be maintained for some time, and, although the student does not feel well, friends and relatives may be kept in ignorance that anything is wrong. The first really important symptom is sleeplessness; when this sets in there is cause for alarm. Work and want of sleep is burning the candle at both ends. Loss of sleep is brought about thus:— when the brain is being actively exercised there is an increase of blood in its vessels—this is spoken of as "functional hyperæmia." If we continue the exercise of the brain powers too long there is a tendency for the blood to remain in too great quantity, from the cells becoming exhausted and not being able to control the vessels. In sleep the amount of blood is diminished, and it cannot be procured if this functional hyperæmia persists. In the absence of sleep the cells cannot recover themselves, and their activity becomes impaired. Headache, loss of appetite, and general listlessness follow; then changes in the character of the blood, and the trains of symptoms so ably described by Dr Clouston. As soon as a child or young person develops continuous headache, work should be discontinued or much lessened.

No time is left us to discuss the influences bearing on the establishment and maintenance of brain health over which the individual has control. In point of fact, this ground has been traversed by former lecturers, more especially in the addresses given by Professor Annandale to young men, and by Dr Angus Macdonald and Dr Halliday Croom to women. These gentlemen laid before their audiences certain pertinent facts, and it would be a mere work of supererogation for me to attempt to repeat what they said, even were it possible to do so to a mixed audience. As these lectures have not been printed, I would urge on the committee the propriety of requesting these gentlemen to repeat these lectures year by year, for such notes of warning cannot be sounded too often.

Were this lecture to be extended it could only be in the direction of the enunciation of a series of moral platitudes inculcating temperance, which would be insulting to your intelligence to submit to you. Every man knows that it is wrong to indulge

in excess, and I would merely remind you that temperance does not indicate merely abstention from alcoholic stimulants, but from excess of any kind. I hold that the lecturer who exceeds sixty minutes in his address is intemperate. I will therefore conclude by saying that I have to-night endeavoured to lay before you certain matters from the point of view taken by a man living very much in the atmosphere of nervous disease. Most men working in the department of medicine that I do recognise that if there is a hope of diminishing the amount of brain disease, it is to be effected by preventive medicine, and I have therefore directed your attention more especially to the transgressions of the father than to those of the son.

DOMESTIC ECONOMY,

As Regards Food and Cookery.

By Miss PHŒBE BLYTH.

When the Committee, who arranged this course of Lectures, proposed that I should undertake one of them, and intimated the subject they wished me to treat of, the first thought that presented itself to my mind was "Clapham Junction," and this word remained so steadily before me for some days that I could not resist introducing our subject to you by this name. Through that Junction there pass in the course of twenty-four hours, no less than seven hundred trains, or one in every two minutes, and so many lines meet there and start thence, that it is commonly said that from "Clapham Junction" you may take your departure for any part of the known world. Something similar may be said of our subject for this evening, as, starting with domestic economy, food, and cookery, we may proceed to any subject we care for, that touches the welfare of human beings.

Political economy, geography, taxes, temperance, employments of various kinds, exercise, ventilation, physiology with its subdivisions of circulation, respiration and digestion, education, intellectual and moral, these and many other points may all be reached, with food and cookery to start from.

In assigning for one lecture a subject capable of such numerous and wide ramifications, the committee have sufficiently indicated the way in which it is to be treated. Only *some leading* ideas can

be presented, *some* principles laid down as general guides, and *some* suggestions made to be elsewhere minutely dwelt upon. It may be that some points will be alluded to that have already been brought before you in detail or will hereafter be so presented. Should I thus repeat what you have already heard, or seem to intrude on the domain of others, I must hope to be excused, seeing that it is consequent on the nature of my subject; for as an engineer who wished to explain fully the use and action of a piston, would have to speak of many other parts of a steam-engine, so a glance must be taken at many points if we would appreciate the importance of cookery and the relation in which it stands to other things.

In our subject, as it is entitled, we have three objects presented to us. It matters *little* in *what order* we refer to these, but *much* that we should have distinctly before us the relations which exist among them. The words "Domestic Economy," or in homely and therefore more hearty "Saxon" terms, the laws of the house or home, lead our thoughts at once to the dwellers in the home, so that we may allow this term to represent "human beings,"—"all people that on earth do dwell." "Food" is too familiar a word to need any comment, but we may pause for a little to consider how and where it is provided.

Here we must extend our view, as food is found everywhere; the sea teems with it, whether we take what the shallow waters give us, search in the holes and crannies of the rocks, or with our hardy fisherman go out to the "deep sea fishing." The air yields its quota, while the earth in all its varied climates gives richly of its vegetable and animal productions. In every direction the continuous and ever-renewed supply is so abundant that were any production unused, it would increase to the destruction or obliteration of others. Nowhere is this more evident than among the "finny tribes." When we learn that several millions of eggs are in the roe of *one* cod, that a perch roe, weighing half a pound, contains 280,000 ova, and that on one shore in Cornwall in one day the yield of pilchard was 10,000 hogsheads or 25,000,000 of fishes, we may quote with emphasis some grand

lines of Milton, used by "Comus" for a different purpose but fairly applicable to ours. He says :—

> "Wherefore did nature pour her bounties forth
> With such a full and unwithdrawing hand,
> Covering the earth with odours, fruits, and flocks,
> Thronging the sea with spawn innumerable?
>
> If all the world
> Should in a pet of temperance feed on pulse,
> The All-Giver would be unthank'd, would be unpraised,
> Not half his riches known, and yet despised,
> And we should serve Him as a grudging Master,
> As a penurious niggard of His wealth,
> And live like nature's bastards, not her sons,
> Who would be quite surcharged with her own weight,
> And strangled with her waste fertility;
> The earth cumber'd, and the wing'd air dark'd with plumes,
> The herds would over-multitude their lords,
> The sea o'erfraught would swell."

Given then these two factors, man on the one side, food on the other, between them comes the cook or cookery. Man has to be *made* strong and healthy or *kept* so; and not only this, but he must be capable of a certain amount of exertion. Cookery should enable us to produce this result in the best way, that is, to the greatest advantage of the food and of the man,—at the smallest outlay of food and the greatest gain to the man.

Let us dwell for a few moments on this aspect of the *use* of food. As we can remember no time when we did not take food, and cannot easily imagine a life in which it would not be required, it seems either startling or superfluous to discuss its use. What! it may be said, do we not take food in order to allay the cravings of hunger, to satisfy our appetite? So it may seem, but this is not the ultimate purpose of taking food, the fact being that appetite exists in order to incline us to take food, not food because of the appetite. The French dramatist Molière, in his play of "The Miser," represents that miserable creature, when he *must* have some guests at dinner, as arranging with his cook for a repast of which only very little can be eaten, for it is to consist of dishes which

will soon eloy and surfeit whether or not they nourish those who partake of them. He defends this proeeeding by the philosophieal remark that we should not "live to eat," but "eat to live." When we, like him, reeognise that we do not "live to eat," but eat or should eat for the sake of not only *living*, but *living well*—that is usefully, nobly, serviceably in the "God-appointed when and where"—we exalt the place of her whom the Germans tenderly eall the House-mother, with whom lie the choiee and preparation of the food.

We have to do then to-night with no trifling or insignifieant question, but with one of vital importanee. That it is so, let me show by a single example related by Mrs Buckton :—"A few years ago several of our soldiers who lived in some London barraeks were nearly starved to death. They became thin and weak. On enquiry, it was found that they never had anything but boiled meat, whieh was boiled to a rag and the liquid thrown away." In the liquid went all the strength of the meat. Here we see how a set of strong men, for whom nourishing food was provided, got no good from it entirely from the ignorance of the person who prepared it.

I understand that I am to give the A B C of eookery for the use both of those who do all their own eooking, and of those who only direet or judge of the cooking done for them. In this, as in other cases, if the alphabet be well known and its resourees understood, an ordinary intelligenee can make a right use of its combinations, and even experiment upon new ones. If the *why* and *because* of some dishes or processes be made plain, a great step in advance has been taken by the would-be eook. Instead of giving you a number of reeeipts, we shall employ this test in some directions, and mark how it opens up to us prineiples which ean be widely applied.

For example, we take the useful and eonstantly needed process of boiling potatoes, for whieh we find the following direetions :—

1. Wash potatoes in *cold* water, never hot. Why? Because warm water would draw away some of the nourishment.

2. Potatoes are best when boiled in their skins. Why? Because the most nourishing part is next to the skin, and the skin not being porous, keeps in the nourishment.

3. Old potatoes are put on the fire with *cold* water, while young ones are put into boiling water. Why? Because *slow* cooking is needed to get to the heart of the old and somewhat *hard* tuber, while it would make the young ones soft and watery.

4. Do not cover them with water till they are about to be set on the fire? Why? Because if they stand long, even in *cold* water, nourishment is lost.

5. Let all the potatoes boiled at one time be as nearly as possible of the same size. Why? That we may not have some hard and others in a pulp, but all equally well cooked.

6. Keep them covered while they are being cooked. Why? Because if the pan be wholly or partly uncovered, the steam in escaping carries off some of the heat, and involves prolonged cooking.

7. When they are sufficiently cooked the water is poured off, and they are again set near the fire merely covered with a cloth of loose texture, or with the lid of the saucepan tilted to one side. Why? Because we must now let the superfluous moisture escape that the potato may be mealy, not watery.

Again, in looking through most cookery-books we find certain receipts in which we are told to beat up eggs as a whole, while in others we are directed to beat the yolks and whites separately. Does mere caprice dictate this? Certainly not. There is a *principle* by which we can reduce what seem mere arbitrary irregularities to one single rule, as can be easily shown. The yolk of an egg is largely oleaginous or oily, in its nature, while the white being albuminous, is viscid or sticky. When beaten together, these make a smooth mass; but when the latter is beaten alone, it forms a froth or foam of air-bubbles, small at first, but expanding as everything does under the influence of heat. Here, then, we have our guide. When we desire only the *richness* of eggs, we beat yolk and white together, when we also require *lightness*, we shall do well to beat them separately.

The actual processes employed in making food fit for the use of man are few; they may be almost exhausted in the short list of boiling, roasting, frying, broiling, and stewing, whether under a cover of pastry or not, with the preparation of tea, coffee, and cocoa.

Some principles are of such wide application that they refer to one, two, or even three of these processes. Let me give you an example of this. In the cooking of butcher meat one of two purposes must always be in view, and different means must be employed as we aim at the one or the other. We either wish to keep the strength and flavour *in* the meat, or we wish to get them *out*. When we boil meat to be presented as a joint, we wish to keep the flavour *in;* when we use it for soup, we wish to get the flavour *out*. With such different purposes in view, we must treat the meat differently.

The existence of albumen has been referred to in previous lectures, with the fact that it coagulates, or becomes softly solid at boiling heat, as is most familiarly seen in a plain boiled egg. By plunging our meat, suppose a piece of mutton, into boiling water, the water is put off the boil; it must then be allowed again to reach the boiling point, when it will harden the albumen of the meat through a thin coating on the surface. If we allow the saucepan to remain on the fire, at the boiling point, this hardening process will go deeper and deeper into the mutton, hardening more and more albumen, till at last we have a fine tough piece of meat to present at table. No one enjoys it; while it is eaten, sundry complaints are made against the butcher for his bad mutton, and we may find realised, the definition of digestion given by one who had been crammed with intellectual food unfit for her to digest. The definition runs thus:—"Digestion is pains in the head, pains in the stomach, bad tempers." If such an occurrence were to happen once to an inexperienced but right-minded housewife, she would not be content with this, she would inquire here and there from the experienced, and armed with better knowledge, when she again provides mutton for dinner, she adopts a different course from the first. This time,

as soon as the water with the mutton in it has boiled for a few minutes, she draws it aside to simmer, not to *boil*, till the mutton is sufficiently cooked. The coating of hardened albumen which was formed at first keeps in all the juices, as it stops up the pores by which the flavour and gravy would have escaped, while the simmering cooks the meat and this time a tender nutritious dish is the result.

If this plan for keeping *in* the juices of meat be once thoroughly understood and taken hold of, its wide application in various ways will be very serviceable. This is the reason that when meat is to be stewed it is *browned* first, as we do not wish much of the juices of the meat to pass into the gravy. We attain the same end in *roasting*, by applying a strong heat for the first ten minutes, and a gentler one afterwards. When we cook a steak on the gridiron, wishing to keep *in* every particle of the nutritious juice, we must take care to have a hot, clear fire which will quickly form the outside coating of solidified albumen; this we must not injure, and therefore the cookery-book warns us against plunging a fork into the steak, and the ironmonger supplies us with beef steak tongs. We have here, too, the explanation of the treatment of meat that has to be *re*boiled—a ham, for example. In its first boiling, all the juice is kept in by the thick, hard skin of the pachyderm which supplies it. Should it be so partially cooked that it is necessary to repeat the process, something must be provided to take the place of this skin, and prevent the juice from passing into the water, so that nothing but insipid fibre will remain. This purpose is attained by covering the joint with a moderately thin paste of flour and water—a paste which is easily removed; thus leaving the ham well cooked and with all its original flavour.

Let us now see what is to be done if we wish to *withdraw* the juices from a piece of meat. We then plunge the meat, whole or in pieces, into water, *cold*, or very slightly heated, to simmer for hours. No coating of thickened albumen is made, and the juices of the meat are drawn out from it to enrich the water and transform it into soup, or with the addition of barley and vegetables into our own wholesome Scotch broth. Meg

Dods (keeper of the hostelry at St Ronan's Well), and a great authority in cookery, asserts that in this matter of soups the French stand first, the Scotch next, and the English below them both—the difference arising chiefly from the greater or less amount of time allowed for amalgamation. She refers, of course, to popular practice not to lordly kitchens. Her assertion will be stoutly denied by those who think only of a weak liquid in which float independently, grains of hard barley and pieces that may be counted of vegetables, but will be assented to by all who know how substantial a meal may be made of good barley broth, well thickened with vegetables, and which has been from four to six hours on or at the fire. This slow boiling softens, plumps and whitens meat, and facilitates the removal of scum, an important matter either for soup, broth, or boiled meat.

This sort of reasoning might be carried on indefinitely and always with advantage. I hint at only a few more points.

Why should bread that is to be added to soup be toasted? Because if untoasted, the bread will swell, crumble, and spoil the appearance of the soup. Cheese is presented with preparations of macaroni, or other Italian pastes, *because* they have no flavour in themselves, and we must add some to make the dish palatable, as well as to increase its nutritive power. The state of the fire is of paramount importance in frying, *because* with too strong a fire the fat becomes so hot that the substance placed in it is merely scorched without being heated through; and if the fire be too weak the food will be *stewed* in fat, not fried.

I give one more instance before I pass on to another phase of our subject. You have been told that starch exists in large quantities in many vegetable productions, one-seventh of potato, one-half of wheat, one-third of peas and beans, three-fourths of rice and of Indian corn being starch; that arrowroot is only starch from a tuberous root, and that tapioca and sago are nearly pure starch. We learn, also, that starch which is insoluble and indigestible in its simple state is digestible if exposed to the action of an acid and then to heat, as it is then converted into sugar. We all know, too, that sugar dissolves easily in liquid,

so in this condition produced, as it is by digestion, what *was* starch and is *now* sugar is taken up by the blood, and by its circulation to all parts of the body, it imparts heat and force. We have here the reason why all foods containing starch must be well cooked, as otherwise the starch cells will not burst, and though they are received into the body they do it *no good*. This applies to wheat, oats, sago, potatoes, etc., while other vegetables, such as onions, and tomatoes, which have little or no starch, *may* be eaten raw by those who have a taste for them in that state. This last illustration leads us to remark that within or beyond each of the "whys" and "becauses" which have been given, there are other "whys" and "becauses" which might be entered upon; but these take us into the region of chemistry and are not needed for the practical cook in her daily work.

While it is desirable to *know* such points regarding the *theory* of cooking, it is equally necessary, or perhaps more so, to *practise* it as an *art;* indeed, although art has been defined as "knowledge applied to a practical purpose," yet in the experience of individuals, as in the progress of civilization, art *precedes* science, for material wants insist on being satisfied. The *practice* of cookery arranges itself under two heads, according to the age of those concerned. First, some children and young people, who may be helpful, or even skilful in some parts of the *art* of cookery, such as the gathering and preparation of vegetables, points of cleanliness, order, &c., &c., long before it is wise or needful to speak of the science involved in what they do: it will be a great good, however, for their after life, if these points be made so habitual to them as to be matters of course. They can use their feet to run and their hands to work, sooner than we should tax their brains to think.

Some cooks never get beyond this handicraft and so remain always in the lower ranks, but when "knowledge" or, if you choose, "science," is added to art, the whole subject of cookery is raised. It will be matter of congratulation should the book-education, now so largely insisted on, result in this higher view of every manual work, not in the foolish idea, sometimes expressed

and even acted upon, that it is undignified or unworthy of consideration.

Again, practice is important to those who are at the head of affairs, in order that excellence may be secured; this applies to everything, from the infusing of tea or making of porridge, to producing good broth or rich pastry—the skilful operator must be kept well in practice by frequent repetition. This may seem a superfluous remark, but it can scarcely be deemed so in view of the hours of daily practice given to *at*tain or *re*tain rapid manipulation on a musical instrument, contrasted with the *one* occasion held to be enough for learning to prepare a good dish. In Miss Mitford's "By-gone Days in our Village" we find an account of some children who tried to spin, but had the grief of seeing the flax which had passed in a fine thread through the nurse's hands, snap in theirs. "Why cannot we do it, Peg?" they say, "it seems simple." "Just, bairns," answers the nurse, "because ye maun first *learn* a thing 'fore ye can do it *well*; it's only *practice* that makes *perfection.*" This aphorism applied by the nurse to spinning, has equal force in reference to cooking.

Having thus considered the relation of food to man, and the need of cookery to enable us to make a good use of the raw materials, with some of the means to secure this, let us now look at some of the conditions by which the food in the first place, and cookery in the second, can be secured: for it is not enough for these ends to have a house with a woman in it, though we might sometimes think so from the way in which the question is spoken of. We have abundant scope for going far a-field here, as many paths diverging from our "junction" attract us. Of these we can follow only a few. Honest labour on the part of the man; trouble, time, and thought on the part of the woman, with frugality and thrift from both. Of the labour, which is to provide all that the housekeeper must have, I scarcely need to speak, except to note that besides the actual food to be consumed, it must supply fuel, materials for cleaning, a proper choice of utensils, and that these materials and utensils must be renewed from time to time: this belongs to him who bears the high name

of the "bread winner," the husband, the bond or strength of the house. This last item of utensils is of moment both as an expense to be provided for, and in its influence, as on it depends much as possible economy of fuel, of labour, and of provisions. It bodes well for a new household when the kitchen, or the "but," is fitly set up with deal table and dresser, with useful crockery and ironmongery, before the room, or the "ben," gets a mahogany table, a mirror, or a piano.

Labour of another kind is required from the wife. Her labour generally includes the selecting and purchasing of provisions, which must be done with judgment and forethought,—the preparation of this food, often requiring a great deal of time,—and next, the actual cooking. With her rests the whole question of delicate cleanliness in herself, in the food, and in all the utensils used. Dishes must be fresh and sweet, no particle of fat should be left in the sauce-pan, no flavour of onion or fish in the frying-pan, knives have to be scoured, kettles burnished outside that they may quickly boil, crockery scrupulously clean both outside and inside so as to be pleasant to handle, the very tables and floor should be free from greasy or other stains, and each meal should be orderly in its arrangements.

For all this, and for the process of cooking itself, *time* is needed, and some of you must have anticipated the conclusion I would press on you,—that the house-mother must be *in* the house. Of all the devices of modern times, none is more ruinous for the physical, mental, and moral welfare of families than that of the wife and mother being withdrawn from her place in the house to go out to some other work. Hours might be spent on this subject; I must content myself with a few weighty words from a speaker at one of the meetings of the British Association. "The mother must retain her true place in the household, if the household is to be comfortable, the children properly nursed, the food and clothing sufficient and nourishing, the father attached to his family, and his home. The welfare of a family will be more promoted by a mother at home, than by her adding a few shillings a week to the family income at the cost of diseased and

dying children, of unfit food, of discomfort to all, and of expensive habits in an absent husband." *

This leads us directly to the question of thrift, or the art of thriving. I am pretty sure of a hearty response when I express my conviction that you all want to *thrive*. Can I be as confident, and will you be as cordial, if I say that you are all ready to be thrifty? Some people speak of "thriving" as if it meant *only* and *always* a good deal of money coming in, with no reference to *how* it is to go out. The good proverb, "a penny hained is a penny gained," has no meaning for them, and so pence are squandered till shillings disappear, and the shillings soon mount up to a crown, which makes a large hole in a pound. This is not the time to enumerate the many injurious ways in which money is thus squandered. You can supply the blank for yourselves. I will mention only one,—the many coppers that, in some houses, are given to children for sweets and cakes. I am told, by those who have the means of knowing, that this outlay is sometimes more than the weekly school fee, while I *know* that where children are under proper control, one copper a week suffices them. This is but a sample of the want of thrift which keeps down many a family, and greatly hinders good feeding. We all agree in disapproving of the practice of living "from hand to mouth," as the saying is—meaning that no sooner has the hand secured some good, or the means of procuring it, than it is immediately consumed by the mouth. Bad as this is, matters are far worse when the mode of living adopted is from "mouth to hand," by which I mean that the mouth *first* consumes what the hand must *afterwards* provide the means of paying for. It has been said, and said truly, that as there is a dignity in earning money, there is also a dignity in spending it. This is true, but to have this dignity, the spending of money must include many good things, and, *imperatively*, it must mean freedom from debt, with the independent and upright feeling which this bestows. Those who are not only free from debt, but can pay *when* they purchase, have many advantages over those

* Rev. Worthington, at Bristol Association at Nottingham, 1866.

who have "a *book*," as the saying is. The one knows how far she is going, the other soon loses sight of the state of her accounts, and is distressed and over-weighted when she finds herself far beyond her reckoning. Again, those who have money in hand can purchase at an advantage when a glut in the market lowers prices, or, they may buy such quantities as give an advantage to the purchaser, and benefit in articles, which, like soap, improve by being kept. The practice of purchasing in very small quantities—just what seems wanted for the coming meal, is a most extravagant one. The *actual* cost is more for a small quantity than for a larger one; then there is the waste of either too little to make the dish good, or too much, while it is so little beyond what is needed—that it is not considered worth setting aside; and so it is wasted. I need not dwell on the great gain of the *ready money* system—it is patent to every one in the co-operative stores, which depend entirely on this for the low rates at which some of their goods are sold. The purchaser, with money in hand, can do better than even at a Co-operative; for if one dealer can only offer what is unsuitable in itself, high in price, or poor in quality, the purchaser can go elsewhere and choose for herself. The poor thrall of "a book," as a running account is called, can make no such choice, but must take what she can get.

Now, this independent action can be secured in any class only by fixing the habitual expenditure below the income, so that when work is slack, or sickness invades the dwelling, there is a reserve which can be resorted to, which will keep away the grim figures of want, debt, or begging. I am not drawing upon my fancy in these remarks. I know of those who have for years lived from mouth to hand, and who never get over the hill Difficulty, or out of the slough of despond. I know, too, and could tell you, did time permit, of others who never spent beyond what they had, and have, step by step, risen from grinding poverty to comfort and independence, who are maintaining themselves, and have even a reserve in the bank. Thrift, properly understood, is wholly removed from parsimony; it does not mean food of bad quality, or a table so scantily supplied that it whets the appetite with a

desire for more, while it fails to appease it by what is supplied—it means the purchase of economical, not dear pieces of meat—it means slow and careful cooking—it means abundant meals, which seem to bid a welcome to all-comers. Neither does thrift refer only to humble homes; it is said to be less frequently found among the wage-earning class than among those who have salaries, though the annual receipts may be less in the latter than in the former case; and I *know* that in many kitchens of those that are called rich, such economy is practised, such good use is made of everything that enters them, as would either surprise or shame others with smaller incomes.

I must now consider thrift in the actual cooking. It is said that the better the cook is the more economical will she be. I would modify this a little, and say that the more *intelligence* a woman has, the more economy can she exercise in her kitchen. I have told you how the application of a few principles will get the full amount of nourishment from what is provided, but intelligent thrift will do more, for it will provide a good savoury meal out of what is only waste to an ignorant housewife. A skilful combination of what has been left at one or two meals, with the addition of a savoury or sweet seasoning from the store closet, will "hain" many a penny which otherwise would be wasted. Remnants of bread, a crust of cheese, scraps of meat, remains of fish may all be dealt with in this way. You have seen in the tables presented to you on other occasions that animal and vegetable food each furnish, though in varying proportions, the different requisites for wholesome food. Without confining ourselves to a diet, either wholly or mostly vegetarian, much money might be saved by a diet drawn less from the animal kingdom, and more from the vegetable kingdom than is now common. The variety thus provided cannot easily be exhausted. The garden gives us roots, tubers, bulbs, leaves, pods, and seeds. The orchard yields its fruits, and the field its cereals or grains; white farinaceous foods are prepared from different parts of plants. With such a choice, and a little meat or fish with spices, there is no end to the combinations that may be made.

We are here brought into contact with the need and benefit of "variety" as an important point to be attended to in arranging the food and cookery of a family. Each meal should in itself supply the different ingredients required by our bodies, *fat, oil, or starch*, to make them warm—fibrin, to give flesh; minerals, such as salts, to make bone; and so on. Many popular dishes meet these requirements, and have become matters of habit and taste, while they are scientifically good, such as—Liver and bacon, beans and bacon, bacon and greens, bread and cheese, bread and butter, cow-heel with sauce of milk, a little butter, and seasoning of parsley, rice with milk, suet, or cheese, bread or potatoes and meat, tripe and onions, fat pork and pease pudding, butter to white fish. When the Irishman eats his potatoes with butter-milk, or the curler, after hours at the rink, sits down to his fat beef and greens, they are taking what they like, but they are also taking what is very good for them. And so with a dish not much used here, kol-cannon. The potato is poor in gluten, the cabbage is unusually rich in this production; mix the two and you approach the composition of wheaten bread. Beat the potatoes and boiled cabbage together, put in a little pork fat, salt, and pepper, and you have a kol-cannon with all the qualities of Scotch oatmeal, and which to some would be more savoury and palatable. A mere potato-eater, fed on this dish, soon becomes stronger and more active. Lastly comes our wholesome national dish of oatmeal porridge "chief o' Scotia's food," with milk, if possible, and failing that, with molasses or treacle. I cannot speak of porridge without turning aside to regret that it is a less usual food than it once was. We can no longer quote as strictly true Dr Johnson's definition of oats as being "food for horses in England, and men in Scotland;" and the result is not a happy one, for neither can we now adopt Lord Elibank's rejoinder, "that nowhere can you see such men and such horses." It is said that even our convicts have a less powerful physique than formerly, and English visitors to Edinburgh sometimes look in vain for the stalwart forms they expected to find in the natives of Scotland. It might be incorrect to ascribe this deterioration

entirely to our change of food, especially for children, but certainly that is one element in the result, and it is not pleasant to think that the change is often made merely because either time or trouble is grudged, certainly not for thrift's sake.

The list I have given shows very markedly that variety does not mean costly dishes. Simple stuffs judiciously alternated, or with only a change of seasoning will secure what is needed. For example, let us add to flour and suet, at one time, a little treacle, at another, some preserves, another day, a handful of dried fruit, and we have three varieties of dumplings; and a fourth and fifth may be provided by putting either apples or an onion within the paste. You will observe that some of these will be more appropriate for one season than another, because more easily obtained then, while others may be had at all seasons. Variety should also appear when one meal is compared with another. Whether sameness happens with tea, as it sometimes is here, or with damper as it Australia, the result is bad. A properly arranged diet will avoid this, and will alternate lighter with more substantial meals. Variety must go beyond this, however, and should include changes, from day to day, of all but such simple things as bread and porridge. An unvaried repetition even every *week* is to be avoided.

In providing this variety, we have many aids — every season brings a change of fish, flesh, or fowl, as well as of vegetable products; commerce brings for our use the productions of every clime, and even legislation helps us by alterations in the tariff, as in removing the tax upon sugar. This variety without unwarrantable outlay, calls for ingenuity on the part of the housekeeper, but it is worth her trouble, as she gives it not merely to please the palate, but that by it she may stimulate the appetite, give a relish to the food, and improve the digestion. We may often get hints on such points from the habits or treatment of the lower animals; and here we may learn from the dairyman. As he requires to vary the food of his cows, if he is to keep up the full supply of milk, in like manner must we vary the food we provide for our households, if they are to be strong and

hearty. High authority can be given for this mixed diet. Hall, Bishop of Exeter, afterwards of Norwich, referring to his own employment, says: "One while mine *eyes* are busied, another while my *hand*, and sometimes my *mind* takes the burthen from them both; wherein I would imitate the skilfullest cooks, which make the best dishes with manifold mixtures." You will observe that the *variety* recommended lies in the material used, much more than in the processes adopted, as we have already noted that they are not very numerous, and may be included under Boiling, Stewing, Baking, Roasting, Frying.

Let me now present two "Interiors" for your consideration—the one to be condemned, the other to be imitated. In the first (which is borrowed from Soyer), The husband, who is employed by a railway contractor, and is what the world calls middling well off, arrives home, and asks his wife what he can have for dinner, the hour of her dinner, and that of the children having long passed. "What would you like to have?" was her question. "Anything you have." "Let's see? why—we have nothing, but I can get you a mutton chop, or steak." "Can I have nothing else; I am tired of chops and steaks." "Why, Jamie, what can be better than a chop or a steak?" "Well, let me have a steak." "You had that yesterday; now, let me get you a chop. I always make it my duty to study your comfort; and I have been reading not long since, that nothing is so wholesome as a change of food, since which time I have made a point of varying our bill of fare, as they call it." "Very well, send for two chops." In a few minutes the messenger, whether wife or child, returns, saying she could get no chops, but has got a nice piece of steak. "Very well. That will do as well, will it not?" to her husband, who is reading a periodical. "Yes; but how long will you keep me here before it is done?" "Not a minute, just enough to do it well on the gridiron." The fire, however, is not fit for broiling. "Well, I shall fry it," she says. The husband, hearing this, exclaims, "Drat the frying-pan, it is always so greasy." "Then, how would you like to have it?" "Not at all," is his reply, throwing

down the paper; "bother the place, there is no getting any vietuals properly eooked here. I must go to the cook shop and have it." He seizes his hat, and slamming the door, makes his exit in a passion.

I have presented to your imagination a scene in a disorderly, ill-arranged home, where little or no forethought is given to the family table. Let us now look at the reverse of the medal. The father, toilworn it may be after a day of bodily labour or mental harassment turns towards his home, and as he does so a warm glow of love to those whom he will find there kindles in his heart. He arrives neither fretful nor impatient. His wife is tidy and fresh, the table is prepared, and while a short time is given to the needful "cleaning," the viands are dished, and the father, mother, and children seated. The parents have their dinner, the children their evening meal. They are orderly, obedient, and perhaps silent for a time; only "the lisping infant prattling on the knee" can be tolerated at first—but soon each tells the "ferlies" that have been seen or heard, and the meal is one of refreshing family intereourse. Has the eook-mother no pleasure, do you suppose, in the kindly approbation given to what she has provided and taken trouble in preparing? Has she no reward in seeing how it is relished, while she knows how little money has been needed to give a wholesome and nourishing meal? You know little about it who say so. This should not be all, however, some return should be made to her for all her toil and eare. But does not the ease often stand thus. The man has been from home, where he had variety in the people with whom he eame in eontaet, variety in the oeeupation whieh oxerted his powers, variety in the very surroundings he has had, whether of open air, business mart, workshop, or warehouse, and yet there is a prevailing idea that it is *he,* and he alone, that requires and should get entertainment of some sort in the evening. Would it not be fair that he should give this variety and cheering to his wife whose duties have kept her all day, or nearly so, within the walls of her own house, or with probably no intercourse beyond that with her own children,

which cannot be called companionship? Is it not fair that he should now unite *his* efforts with *hers*, among the children in whatever direction they are needed, and when, after evening worship, if the household be a god-fearing one, the bairns are asleep, are there not confidences to be made to her? plans to be laid for the family life? accounts to be made up for the past? calculations for the future? or some parts to be read from the newspaper which he likely has in his pocket, so that she who has little time for reading may be kept abreast of his social and other interests.

In this large assemblage, there must be, not only *some*, but *many* who are familiar in their own experience with all I have said, and who could and would have said it all themselves, had our places been exchanged. Their houses are the abodes of happy content, cheerful industry, and godly honesty. Cleanliness reigns there, and thrift is practised. Of such homes we hear little, but they are training "honest men and bonnie lassies," who are to be the strength of our country in the coming generation. We know—and it is a joy to know—that in all classes there are such houses—true *homes*. If some from these homes are disposed to be disappointed or displeased with what I have said, or have left unsaid, I beg them to remember that it was not to such as they that I required to speak. The object of this course of Lectures, of which I have had the honour and pleasure to give one, is to instruct the ignorant, to advise the inexperienced, and to warn the imprudent. If they serve also to encourage the well-doers, they accomplish what is desired, and make all who engage in them fellow-workers with Him whom we call our Lord, part of whose work was to strengthen the weak and to cheer the down-hearted.

I must now draw to a close this discursive address, which perhaps has won *too well* a right to be compared to Clapham Junction from the various paths we have taken, wandering in many directions, though never, I trust, missing our points so as to get upon wrong lines. Many parts of our subject have necessarily been left

untouched, such as cold-meat cookery; cookery for the sick; food for infants or children; salting of meat; quantity for each person, varying with age, sex, or employment; the need of taking food in *fresh* air, not where hours have been spent in working. Neither have I given you receipts for dishes, nor directions for cleaning, as these are to be found in every manual on Domestic Economy, and to them I refer you. I have only endeavoured to show that to attend well to the food and cookery of a household means that the hands, the head, and the heart are all needed; for she who attends to it must work with the hands, think with the head, and feel with the heart that this duty is one which neither exalted piety nor high intellect should look askance at as beneath notice, but is so important as to deserve the careful, continuous, and intelligent application of whoever has the charge of it.

I have told you that to succeed in it there must be such forethought and wisdom in forming plans, and such diligence in carrying them out, that the house-mother's place is one neither to be lightly thought of, nor ungraciously acknowledged, but to be held in high honour and esteem.

My aim has been less to exhaust any point than to awaken a lively interest in the subject, and to show what conditions are required for the economy of the house. If that aim has been accomplished, it remains for the honest industry of man and the ingenuity of women, stimulated by wifely and motherly love, to make the family table the centre of much good, while she merits the praise of being one who "looketh well to the ways of her household and eateth not the bread of idleness."

DOMESTIC ECONOMY,

AS REGARDS

Clothing and Household Arrangements.

By W. ALLAN JAMIESON, M.D.

If it is permissible to venture an opinion, I have a suspicion that the members of Committee of these Health Lectures chose for me the first item of this subject, because having last year spoken about the skin as nature formed it, I was bound this year to tell how art protects it. This is all well. But how about the household arrangements? these have but an indirect connection with clothing. On this point I must fain shelter myself behind the Committee. They are infallible; and having put clothing and household arrangements together, and asked me to give my deliverance on these severally and conjoined, I can but endeavour to fulfil their wish to the best of my ability.

First, then, of clothing. Very different indeed are the ideas of mankind as to this. Among the least civilized of the human race, it is little more than a means of protection from cold, an adjunct to be dispensed with more or less entirely in proportion as the spot of earth's surface on which they dwell receives a larger or a smaller share of solar heat. Civilization has, however, made the use of clothes absolute; yet even here the instincts of savage life in this as in more serious aspects peep out now and then. See how eager children are to divest themselves of shoes and stockings, and career in freedom on the sands. Or how again during summer the juvenile population of streets occupied by the working classes are never so happy as when with bare feet (to the horror and astonishment of our Southern brethren) they can play

untrammelled on the flags. And well for them. The muscles, cramped and pinched by the hard shoe, have full scope, and the foot gains in strength and pliancy what it may lose in softness.

The object of clothing varies under different circumstances. Thus in cold climates its purpose is to retain and economize the heat which is constantly being produced within the body by vital processes, such as digestion, respiration, muscular exercise, and brain work. Were this heat not conserved by our clothes it would depart rapidly by radiation and evaporation. This loss is aided materially by cold winds and a temperature without very much lower than our own. Necessity, therefore, as much as civilization compels us to wear clothes in order to keep ourselves warm. A further reason, not unknown among savage nations, is that of wearing clothes for display.

In hot countries again the body must be covered as a protection against the direct and scorching rays of the sun. It is still, I believe, a disputed question whether the dark races of mankind owe their colour to a gradual process of tanning by the beams of light acting on generation after generation, or were primarily dark. A brown skin, however obtained, serves to lessen to its possessor the danger of direct solar heat, while the skins and bodies generally of the fairer races, partly from not being habituated, partly from want of this protective dark staining, are, when exposed, affected injuriously by the tropical rays.

When we turn to the materials of which, and the mode in which, our clothes should be made, two points claim notice. Our clothing should be as light as is consistent with sufficient warmth. Weight is burdensome, and it should be so fashioned as not to interfere with the proper movements of the body. Easy clothes are much warmer than tight ones, and, paradoxical though it seems, they may be said with equal truth to be cooler in warm weather. Admitting of more perfect ventilation, they do not so readily become moist with perspiration, and then cling unpleasantly to the wearer. Some materials permit heat to pass too quickly through them, and do not sufficiently impede evaporation. We have, however, many substances which only admit of the gradual radiation or escape of heat from the

body. Of these, wool of many different sorts is most generally suitable; and this is fortunately produced in such abundance and at so reasonable a price that all can obtain clothes made from it. And in regard to this we can, as so often happens, take a hint from Nature. Those of the lower animals which, from their mode of life, are necessarily exposed to great alterations of temperature, have a loose open fleece or hairy covering, so a loose, open-wove porous material makes the warmest garment. Hence knitted underclothing and fleecy or thick soft cloth for outer wear are cosiest, though it must be admitted not in all cases the most durable; at least when we take into account some trades and occupations. Colour, too, has an influence. If equally thick, dark stuffs are warmest, because such absorb more of the sun's heat-rays. Light coloured articles of dress reflect more of these rays, and hence are cooler. Grey presents a medium tint which suits our climate well. I said, if equally thick; this is not absolutely true, but it enables me to make a practical observation which every one of you could, I believe, confirm from his own experience. More colds are caught at funerals where black clothes are still almost exclusively worn than anywhere else. Now this is partly, I admit, because these black clothes are, as a rule, thinner than the everyday dress; partly because a degree of depression is, not unnaturally, experienced when we place in their final resting-place the remains of one who while alive was loved or respected. Wearing mourning is a relic of heathenism handed down to us from Roman times. The custom is certainly now-a-days much less rigorously observed, and some have abjured it, as the Society of Friends do. Is it not an apparent protest against Christianity? which while it robs death of its sting, at the same time teaches us that that is but the narrow portal, only gloomy to those who are looking on, which ushers into perpetual day and perfect peace. If some mark of reverence for the dead be thought necessary, let it take the form of a badge, which, worn on our daily clothes, might tend to inspire hope and cherish faith.

Taking up clothing in order, underclothing should always be of wool, and all ought, in this eccentric climate of ours—but the same rule applies to such an one as India,—at all seasons to wear

woollen materials next the skin. This is even more imperative at the two extremes of life, in the case of infants and young children, and aged persons, whose powers of producing heat are less active than those of individuals in the vigour of middle life or of youth. They are therefore less able to resist cold. In winter, either hand-knitted under-vests and drawers, or machine made, in imitation of hand-knitted, are best. In summer these woollen under garments should on no account be entirely laid aside, but when the warm season has fairly set in, here scarcely ever till June is well advanced, thinner and lighter ones made of merino should replace the thicker worn in winter and spring. If any article of underclothing is to be thrown off in summer, it should be the drawers, the under vest never during the day. And here I may remark, that *all* clothing worn in the day time should invariably be put off at night, to be replaced by cotton or linen night dresses. Too many wear under-flannels night and day. The good effects which result from wearing flannel next the skin are thus much lessened. Flannel is worn by day when one is actively occupied, and the perspiration is thereby increased, to prevent our becoming suddenly chilled. This is unnecessary, as a rule, during sleep. Flannel night dresses are preferable, in the case of children, to linen or cotton. They have less heat-producing power, and are besides much more apt to throw off the bed-clothes. For them a night dress, made somewhat like a bathing costume, suits best, as it is then impossible that, though the bed-clothes are tossed off, the child can be entirely exposed. In old persons, and in those with strongly developed rheumatic tendencies, flannel is also the best material for night dresses; but in all these cases there must be special garments for day and night, each to be reserved for its proper time and use. At night the feet must be kept warm, warmed artificially if cold on going to bed, since, unless they are warm, it is not possible to sleep soundly—in many instances even to sleep at all. Underclothing for use in the day should not extend further down the arms than half-way to the elbow. This permits much greater freedom of movement for the arms. It should never be allowed to become too dirty before

being changed, since this renders it both unwholesome to the wearer and unpleasant to those around him. It gets loaded with perspiration and particles cast off from the skin, which, being animal products, tend readily to decompose. Besides, clothes much soiled are more difficult to wash, and being more worn in the process, to permit them to become so is the reverse of economy. A week is the limit to the time they should be worn before being changed, and thus an endeavour should be made to have a sufficient number of underclothes to allow of this necessary frequency of change. There is no special virtue in coloured flannel. One often hears red or blue flannel, especially when new, credited with surprising qualities. It is certainly a doubtful advantage that such does not show dirt so soon as white or cream-coloured. It is assuredly not warmer; indeed, brightly dyed wools are often the cause of eruptions on the skin, from some irritating ingredient in the dye used.

The material of which what may be termed intermediate clothing is made, varies in the two sexes. Whatever its component parts consist of, these should not be tight; and, in the case of females, strings and tapes tied round the waist as a means of sustaining any garments are to be avoided, suspension from the shoulders being better. Were the strict underclothing, that worn next the skin, made warm enough, perhaps worn double, there would be less need for the multiplicity of skirts and heavy petticoats still used by some. One woollen under-garment is not so warm as two, even though the one be as thick and as heavy as the two are. The two are separated by a layer of air, and so heat is less rapidly transmitted and lost. Something of what is known as the Bloomer, or rather the modern combination dress, might very well replace all but the gown proper. A very warm material, and not heavy, is found in chamois leather. An under-dress of this has really reason, besides elegance, on its side.

So much has been said on the subject of stays and tight lacing, and with so little real effect, that it seems almost hopeless to offer any suggestion. As to the existence of tight and very tight lacing, one has nothing more to do than take a walk along Princes Street any day in summer to note how many waists are

natural, how many artificial. The large proportion are the latter. It may be admitted that a moderately small waist does, in the case of some women at least, improve their personal appearance, dressed as many are at present. But while this is conceded, does the advantage gained as regards display counterbalance the unquestionable evil effects of forcibly compressing the centre of the body, and displacing and injuring important organs? Many women complain that they cannot walk uphill or upstairs without feeling short of breath. Much of this is due to the natural expansive movements of breathing being limited to a minimum by stays. Their effect, bad in all cases, is worst in growing girls, whose ribs are still yielding and elastic, and thus more easily compressed. Parents are now becoming somewhat more alive to the fact, that there must be for girls as well as boys a due proportion of free out-door exercise associated with the lessons at school. In too many girls the natural supports of the spine, the muscles of the back and chest, have partly been left undeveloped by want of exercise, partly been wasted and cramped by the pressure and the artificial support of hard, unyielding, and too often tightly laced stays. Hence it is that far more girls than boys have twisted spines. Girls would be as straight as boys are usually had they only fair treatment. The muscles of the back being weak, the girl sits habitually to one side or other, and what was at first merely an awkward habit, becomes very soon a decided curvature. It is most unfortunate that there hardly exists a playground worth the name attached to any girls' school. In winter, a large hall should be available for games, gymnastics, and romping generally, in summer, a space out of doors; and were the play hours superintended and the play joined in by the teachers, both those engaged in imparting knowledge and those learning would be the better in every way.* Muscles as well as brains must be exercised and trained to be fit for their work, for muscles are as necessary for women as for men; and if these were the objects of more attention, we would have women better

* Some admirable remarks on this and kindred subjects are to be found in a little book "On Physical Education," by Concordia Löfving, published by Sonnenschein & Co., London, price 1s 6d.

educated, and at the same time more fitted for becoming in time active wives and healthy mothers, or indeed for any duty. Women would certainly then be more free from those severe backaches and that distressing pain in the left side, of which one or other many of my female hearers are but too painfully conscious. It seems to me that this is a most legitimate sphere for the exercise of the energies of those ladies who have their sex's welfare so much at heart.

I am sometimes told that stays are absolutely necessary; without them women would look, it is said, like sacks tied round the middle. If something must be worn to support the figure, a softer and more pliant article might easily be devised. The corset recommended and used at the Girton Ladies' College is reported to be such.

There is a passage in one of the works of a very vigorous and talented authoress of the present day which is worth quoting.

"Miss Lizzie Vane wore a dress which faithfully followed every worst point of the prevailing fashion, and exaggerated all of them a little, by way of originality. Her gown was the gown of the present day. It fitted her almost half the length from her throat to her heels like a skin: it was well tied back just behind the knees, and on the ground behind an abundance of perfectly meaningless little frills arranged upon a spoon or wedged-shaped piece of stuff, waggled and whisked about with her every movement. . . . . .

"Her waist was, let us say, very slim indeed; her bust and hips forced into a prominence displeasing in itself and out of all proportion with the rest of her figure. Her plentiful hair was gathered behind into as small and shabby a round knob as it could by any means be screwed into; in front a great wisp of it was pulled forward, relentlessly cut short, and then curled, frizzed, piled, and towered, both on the front of her head and over her pretty white forehead." Who can say this is an overdrawn picture? It may be conventional thus to distort the human form, but it is not beautiful. Let the dress exhibit natural lines rounded and easy, as they should be in health, to the full, but do not

forcibly misplace portions of the body, to the destruction of health, and the sacrifice of ease, elegance, and grace.

Of those varied humps and prominences which are developed artificially under the direction of fashion from time to time on different parts of the female form, there is nothing to say. They in general reach such proportions as to interfere so much with comfort or progression, that apparently a protest is made, for they vanish and are seen no more. As a rule, they are not actually injurious.

Though the stays may be loose and easy, or absent altogether, dresses are often made or become too tight across the chest. Girls will frequently say, "My dress is not, does not, feel too tight." Yet when it is unbuttoned or unhooked, it will be found that a space, and often a considerable space or gap, exists between the buttons and the button-holes, when the shoulders are held only properly back. This should not be. Such dresses prevent the lungs from expanding in the movements of respiration, interfere with easy and full breathing, narrow the chest, round the shoulders, and favour, if they do not directly lead to, consumption. Dresses for grown up persons should be full across the chest, for growing girls specially so; and when made at first ought to have enough cloth laid in to permit of ready enlargement, for a dress often becomes too small before it is worn out.

In selecting materials for clothes, all staring patterns should be avoided. Self colours or quiet combinations are best. A draper once told me that in ordering goods he had invariably to select some uncommon patterns,—those he showed me might very fairly have been called ugly,—because there were always customers who must have dresses quite distinctive. As regards material, it is always best to purchase really good cloth in the first instance, since honest fabrics always look well when new, and even when worn for some time keep their shape and colour better than inferior ones. Apparent bargains in clothes not seldom turn out anything but satisfactory in the end. When good clothes have been used for a time, they can be made down for children's wear. Thus it is well to bear in mind when selecting clothes, the purposes for which they are to be employed, and whether, though at

the outset designed for better, they will eventually be suitable for work or home duties.

There is an old proverb, "Keep the feet warm and the head cool," and there is more wisdom in this than in many other wise saws. Carried out fully, it is an excellent maxim. Though in summer cotton socks are certainly cool and pleasant, when one can wear thin shoes, and there does not exist any necessity for walking a long distance, woollen stockings are actually much more suitable at all seasons. The late Professor Syme once remarked to his class, that were cotton socks worn all the year through, colds in the head would be unknown, and cited himself as an example of the practice and consequent immunity. But alas for the infallibility of human opinion, not long after I saw the worthy Professor sneezing and otherwise manifesting the signs of as well-marked a cold in the head as one could have. Woollen stockings woven of coarse yarn absorb the perspiration and preserve the feet from blistering, and are cooler than cotton ones on a long walk. Tight garters are frequently worn below the knee by women. "Garters in any position are bad, but if used they should be worn above the knee, as the two tendons to be felt at the back of the joint receive the pressure and act as a bridge to the veins which pass beneath. The garters as usually worn are a frequent cause of enlarged veins in the leg, and by interfering with the blood supply of the foot, also favour the development of chilblains."

Boots and shoes must be easy, broad in the toes and sole generally, while the waist should have some degree of elasticity and not be absolutely rigid. Shoemakers have, it seems to me, an idea that the foot is formed as follows: a great toe in the centre, flanked on each side by a smaller, and outside this again by another still less or little toe. Hence their boot with pointed toe. If any one will examine an infant's foot, still guiltless of stiff shoes, the natural shape of the foot will be found displayed. The length of the great and two adjoining toes will be found to be nearly the same; indeed, sometimes in infancy one or both of these slightly exceeds the great toe in length, the other two toes are shorter. There is also a small space between the great

and second toe, and it was here that a thong which helped to secure the sandal worn by the ancient Greeks was carried up. The great toe and the inner side of the foot form a straight line. Compare the infant's foot with your own, and the distortion which the shoemaker has brought about will be at once visible. The great toe will be found to incline outwards towards the other toes, at a greater or less angle from the perfectly straight line of the inner side of the infant's foot. The smaller toes are more or less bent, perhaps plaited one over another, and can either only with difficulty, or not at all, be straightened out fully. One or more of them have corns, while the nails are misshapen to some extent. All this arises because shoes in general are made more or less wedge-shaped at the toes, and the foot must adapt itself to this imaginary and erroneous model. The normal foot becomes continually broader from the heel to the toes. Boots and shoes are advertised as being made on an anatomical model, but in actual practice the mischief is done while the foot is growing, while fashion and the desire for small feet encourage the evil. The savage who walks barefooted clings to the ground with his foot, which in fact is nearly as pliant as his hand. Much of this prehensile power or capacity for grasping is lost among civilized nations, who wear hard unbending coverings for the feet, but the elasticity, the springiness which the arched form of the instep imparts, remains in great measure if the foot be treated properly. High and narrow heels give an insecure hold of the ground, and throw the weight, which ought to be distributed over the sole, forward on the front part of the base of the toes. This unnatural position, besides rendering the risk of sprained ankles much greater, stretches the fibrous bands which bind the various and complicated bones of the instep into a beautiful arch, strong yet springy. The tough fibres yield, the foot flattens, elasticity and grace of movement disappear to a large extent, and aching pains are often complained of, the cause of which may be easily misunderstood. If we wish to walk elegantly, comfortably, far, and with ease, straight broad soles and low heels must be worn. The fashionable boot, with its thin sole, its narrow, high, pin-like heel, and its pointed toe, gives a tottering gait

quite different from the firm and secure tread we ought to have.

As in the case of dresses, attention should constantly be paid to children's boots and shoes, so as to have them lengthened or renewed as soon as they tend to become short. The foot elongates considerably too in walking, so all boots should have a full half-inch or more of spare length to permit of this. Women's boots and shoes are generally far too thin. Besides being worn thicker, the addition of an inner sole of cork covered with felt excludes damp from the ground or pavement, and aids in keeping the feet warm. These soles should, however, be taken out and dried at night or when the boots are laid aside. Lacing boots are better than elastic side ones, though in some ways the latter are more convenient. Patent leather boots are only suitable for occasional wear; like goloshes they do not allow the escape of perspiration, hence are unhealthy, and if worn constantly engender habitual cold feet.

In winter, at least, woollen gloves should be worn, as best preserving the proper circulation of the blood in the hands, and lessening the chance of chilblains. In the warm seasons silk or cotton ones are preferable to kid.

The second half of our proverb still demands notice. We are told to keep the head cool. Were it possible to form a covering for men's heads which would admit of both light and air in due proportions, a great problem would be solved, as I am certain that baldness would then be reduced to a minimum. No plant can grow in vigour and health unless it has light and air and sufficient nourishment, and the hair may be regarded in one sense as a plant. How do we treat it? We exclude air by wearing a heavy silk hat, which at the same time keeps it in darkness, and we starve it by attaching this hat by means of a hard rim pressed down on the head, which squeezes the arteries, and thus diminishes the proper blood supply. Since hats are a necessity, they should be light, "feather weight," pliant as far as may be, well ventilated, and with a soft band which will compress the arteries of the temple as little as possible. The hat, too, should only be worn when it cannot be laid aside—not constantly, or when in the

house. Ventilation is best secured by having a slight space between the band and the hat proper in front and behind, the hat being close to the head at the sides. It thus does not so much convey the impression of being over large, as when ventilated in this way at the sides also it is apt to do. In addition, there should be a hole in the crown in the hat for cold weather, in the sides and crown in that for summer use.

What can I say of that marvel of variety and elegance, a lady's bonnet? It is, or it ought to be, the perfect setting round a fair face. Like the humming-bird, which, alas! too often adorns it, it is so delicate as to be destroyed if handled rudely, and that airy lightness of pencil is not mine which is requisite to deal with it adequately. At the present moment, so numberless are its forms and hues, that it may with all truth be said, for every face one may be chosen which shall combine the maximum of comfort with the best of taste. Any lady may have a bonnet which is both becoming to the wearer and a real protection to the head, and yet be in the fashion.

There still remain two subjects connected with clothing which demand a brief consideration. One of these is the regulation of dress to suit various ages. Of the coverings necessary for the grown-up person and the elderly, enough has been already said. In the case of infants, the mistake generally committed is to put on too many clothes composed of too numerous separate articles, and of unsuitable materials. Infants should be clothed as nearly as possible exclusively in flannel, as little as possible in cotton. The clothes should be sufficiently loose to permit of free play of the lower limbs, as it is in this manner that the child exercises its muscles preparatory to walking. In delicate children, and under some conditions of ill health, the flannel binder may be advantageous. An active and strong child causes it to wrinkle up and become uncomfortable, and it may be early dispensed with in robust infants certainly, provided a flannel shirt and flannel gown are used as they should be. As infants become older, short sleeves, leaving much of the arm uncovered, and low-cut dresses, exposing the neck and shoulders, are unsuitable in winter. How-

ever prettily these exhibit plump limbs and shoulders, they are frequently the direct cause of colds.

It is a most important matter to adapt our clothes to suit the changing seasons. In autumn, winter, and spring, some addition is needed when we go out of doors, in the form of an over-garment. No one part of the body should be over-loaded with extra clothes, to the exclusion of others. Thus, a fur cape is very well if worn in addition to a jacket, on a cold or raw day, but not alone over the indoor dress. In like manner, the throat should not be muffled up too much. If this be done, the delicate organs of the voice are rendered tender and sensitive, and more apt to suffer from accidental exposure. Outer garments, too, should permit of free use of the arms, and not pin and truss them to the side, as some shapes of ladies' cloaks do. In church, or any crowded place, the cloak, cape, or greatcoat, should if possible be taken off, at any rate, should be thrown open, so that when again closed on coming out into the colder air, its protective effect may be fully experienced. To a neglect of this, and sitting in damp clothes, colds caught in such places are (draughts of air excepted) mainly due.

The subject of household arrangements is a wide one, and, indeed, so comprehensive, that it would require many lectures to deal with it in an exhaustive manner. It might include not only such topics as the choice of a house, the mode in which it should be furnished, painted, or papered, and the plan on which the daily life of its inmates should be conducted, but also many and various ramifications into which the consideration of these matters would lead one. Such a duty if not impossible, would be possibly impertinent, and could scarcely be made to suit even the various grades of working-men for whom, though not exclusively, these lectures are perhaps mainly intended. Still, so much scope does this branch of my subject manifestly permit, that I may select a few points whereon to offer a little advice, or to make some suggestions which have been forced on my notice.

It will be at once admitted, that within the last fifty years, even within the recollection of many here present, a great change has come over people's habits. With our higher civilization, and

particularly with our vastly increased modes of communication, the country has been brought in many ways nearer the town, not perhaps in all instances to the advantage of the former. This communication has levelled down many of the differences of life, of character, and even of language, which existed till recently in parts of the kingdom not remotely separated from one another. With civilization and a larger circulation of money, wants, too, have increased, and many things which were a generation or less ago, either unknown, or articles of luxury found solely among the wealthiest classes of the community, are now indispensable in a working-man's house. Indeed, it may be said, that a working-man of the present day, who is industrious and sober may have comforts and elegancies which were beyond the reach of the nobles of a century back.

It was probably from motives of precaution in unsettled times, so that houses might be as closely packed as possible, and thus more easily defended, that the plan of living in flats, accessible by a common stair, came first into use. Perhaps, too, our frequent communication with France, where the same system prevailed, led also to its introduction; but be that as it may, the arrangement of houses on this system has with some drawbacks, so many advantages that it will likely continue, and indeed has even been adopted in London to a small extent of late. While this plan does not admit of the same degree of privacy, which the small self-contained brick houses do which one sees making up whole towns in Lancashire, it somewhat lessens that wearisome uniformity which renders each street there the exact counterpart of another, and does not spread the buildings over such a large area. Where the members of each flat can realise and act on the supposition that each common stair might be regarded as the joint-residence of one large family, and are willing to give and take, and to fulfil, to the best of their endeavours, the golden rule, all would proceed smoothly and harmoniously. There is too often, however, one or more discordant elements, and these serve to disturb the amicable relations of all. If by any means lands could be jointly taken, and families who are acquainted could live in the same stair, there would be more happiness in

each individual house ; and perhaps fewer flittings on each term day, with the toil, discomfort, and positive destruction of property which each move entails. It is not always possible to choose the house, not even sometimes the locality, in which one would best like to live ; but a house, as far as can be dry, airy, and well-lighted, should be selected. I wish it were possible to do away with area houses altogether. There are still too many area-flats occupied as houses. To some, little exeeption can be taken, others are merely darker than is wholesome, and we have seldom too much sun, for the greater part of the year at any time, or even in any aspect ; but others, besides being dark, are damp and ill ventilated. In these the mother and the young children are the greatest sufferers ; the husband and older children are enough out of doors to counteraet, in some degree, the noxious influences of such dwellings. At the same time much may be done by cleanliness, white-washing, and the admission of air on dry days to lessen the evils of such under-ground abodes.

Great improvement has taken place within easy memory in the lighting of houses. Under the restrictions of the odious window-tax, and in consequenee of the poor quality and high priee of glass, light was admitted scantily and sparingly by means of small, deep, and dingy apertures. These had either no, or but very defective, arrangements for permitting their being opened. And hence the houses of all classes, but particularly those of a poorer description, were close and ill ventilated. That more ill health did not in consequence prevail is certainly remarkable ; but the ruder habits made the inhabitants less sensitive, and they suffered less because their nerves were not so highly strung, and, may I add, because they drank less tea. I am not one of those who regard the introduction of tea as by any means an unmitigated advantage. Its immediate effects are undoubtedly refreshing and invigorating, but its more remote ones are perhaps increased liability to illness. The teapot has its place, and from that place I do not desire to dispossess it ; but it should certainly not be constantly, nor even very often, on the hob. Probably once a day is often enough for most people to take tea. But I have wandered from my subject, seduced therefrom by the China

leaf. On the question of lighting and the admission of fresh air into houses, there is still room for improvement, yet matters are certainly better in this respect than they were a generation ago. Should windows be kept open at night? In summer there is little risk, provided the weather is clear and the window is open from the top, and no direct current comes down on the bed. But in winter, spring, and autumn care must be exercised in regard to this. In thick foggy weather the window must be closed, as the admission of raw damp air, laden with smoke in towns, is certainly deleterious.

Professor Maclagan has so fully dealt with this question of ventilation, that any remarks of mine savour of works of supererogation. I must impress on you, however, the necessity for caution in opening the windows of rooms at night, in which young children or old people sleep, as these are specially susceptible to the influence of cold night air.

The material of which window blinds are made is not a matter of indifference. Of all blinds venetian are the best, as the amount of light, up to almost absolute darkness, can be very simply and easily regulated. Originally these were invariably painted green, many other shades of colour are now employed; but it is doubtful if any one of these is so comfortable and grateful to the eye within the house, or looks so refreshing when viewed from without. We can look for a short time with pleasure into the blue vault of heaven on a cloudless summer day, but nothing so rests and cools the eye as to gaze on verdant fields and stroll or sit under the shade of the green leaves of the forest. If venetian blinds are not obtainable, there are many cheap and excellent substitutes. Blinds made of green worsted or cotton, or some of the grey mixtures so common and so tidy. Yellow or buff and red blinds are glaring. White ones soon dirty, and admit too much light. Where there is a necessity for partially obscuring a window, cane screens are the prettiest and best, and while admitting ample light add much to the appearance of a house from the outside or street. Another mode of preventing over curious neighbours from seeing more than is desirable of the internal domestic arrangements, is to have flowers outside or inside the window. I can quote the high

authority of Lord Rosebery in support of this, as expressed in his very suggestive opening address to the present course of health lectures. I believe we cannot tend flowers, or cherish domestic pets, without being the better for it. The act of kindness, whether this be manifested to a human being, to one of the lower animals who are dependent in their tamed state on man, or to a flower in tending and watering and dressing it, reacts on ourselves and mollifies and softens our own nature. Flowers then on the window sill, ferns or aerial plants hung from the ceiling above the window, cages with birds occupying more or less of the centre are all useful as well as ornamental. Children who are trained at home to be kind to the domestic pets, and who see how tenderly these are handled by their parents, are less likely to ill use other dumb animals with which they may be brought in contact when they go out into the world, and horses, cattle, and sheep would fare better were this training more universal at home.

The walls of the rooms must be painted or papered. Where these can be painted with oil there is so far an advantage that this can be washed down without being harmed. Certain parts of the wood work must be so painted, and when this requires renewal, a time should be selected for doing it when the children, if there are any, can be sent out of the way, or at least can be put into another apartment than the one which is to be painted. Paint when drying gives off peculiarly irritating fumes, due to some decomposition or oxidation of the oil. These act injuriously on many persons, but particularly on children, causing feverishness, sickness, and other disturbances of health. The size in white-wash is also harmful, but perhaps not to the same extent as oil paint. Of all coverings for walls, however, the most generally applicable is paper. The colour of the paper-hanging should be a subdued one, and the pattern such as will harmonize with the size of the room, its furniture, and with the purpose for which it is to be used. A paper should be selected from which the colouring material does not easily rub off, and which does not contain arsenic. It is a mistake to suppose that only green papers are arsenical, or that all greens are so. When a room is being papered afresh, the old paper should invariably be removed before

the new one is put on. Besides being dirty, the accumulated paste decays, and then smells badly. To remove the old costs a little trouble, but this is made up in the greater healthiness of the house, and the smoothness with which the paper adheres to the walls.

Only in this country has the system prevailed to any extent of covering the entire floor of a room with carpet, and this is a comparatively modern innovation. Such a plan has been thought to render an apartment warmer. It deadens sound more than when the wooden floor is left more or less uncovered; but I believe it has no other advantage, and has many drawbacks. The fashion of staining and varnishing or spreading with wax-cloth a space round the sides of the room while the centre alone is carpeted, has much in its favour. It allows of the carpet being much more frequently and easily lifted, and shaken or beat. And thus dust which is unwholesome, cannot collect to such a degree beneath it. Heavy articles of furniture do not need constantly to be moved, and when not in actual contact with the floor, can have the dust easily swept from underneath. Smaller carpets can be used, those can be reversed in various ways, so that they wear more equally, and rooms are rendered airier, more free from dust, more healthy, while economy, an item not to be neglected, is consulted.

In the matter of furniture a change too has taken place for the better. The huge four-posted bedstead with its canopy and curtains, which had held its own as an indispensable article for centuries, and was the admiration of all duly constituted matrons of even a generation ago, has vacated the not inconsiderable space it so amply filled, never probably to return, and if it has left a blank it is one which can be better filled. In the house of the working-man too the box beds are seldom seen, except in the wilder districts of Northumberland, and the more outlying parts of Scotland. At all events they are not now made. Iron and brass and even nickel-plated bedsteads, neat, clean, airy, and occupying less room, have replaced them both, not without some regret on the part of the housewife. The comparative privacy which the well drawn curtains, or the closed wooden shutters of

the box bed gave, compensated, it was thought, for the closeness and darkness which obtained within. Feather beds too have happily disappeared, and hair mattresses, or one of the many varieties of spring beds have replaced these. Since economy of space in the day time is often an object, the camp bedstead is one which deserves greater attention than it has got. This is made by stretching strong canvas across a stout frame which folds up. It needs no mattress, but unless a thick fold of blanket is placed over the canvas, the occupant is apt to find it decidedly cool. This form is most useful for children's beds, since it can so easily be closed during the day, the pillow, blankets, and sheets, folded neatly up, and all put quite out of the way. It is much better than the cupboard bedstead, in which the bedding was shut up from the air all day. The place where the bed should stand is also a matter of some consequence. Often there is a recess in the kitchen into which it is meant to fit. This certainly keeps it out of the way, but has the disadvantage that the bed can only be approached on one side. Such an arrangement is frequently unavoidable. In bed, as in the daytime, the feet should be kept scrupulously warm, the head, and indeed all the rest of the body cool, but not chilly. Unless the feet are warm on getting into bed, sleep is with many almost an impossibility. When it is considered that we spend one third of our whole life in bed, attention to these points is evidently worth notice.

One change has taken place, however, which has told, in many instances disastrously, on the health and lives of all classes—a change which, in view of the immense increase of population in our towns was seemingly indispensable. This is the introduction of water as a means of removing sewage. The older houses into which these alterations were introduced were, in many cases, so built and so arranged internally as to be unsuited for them. In some at least of the more modern, common sense has not always guided the architect. In nearly every kitchen of a working-man's house there exists a sink, and down this too often all manner of refuse is put; indeed the amount of faith in the capacity of the pipe to carry off anything, seems at times all but unlimited. The

trough is frequently clean enough to outward appearance. The housewife scrubs it, empties hot water into it, and, ignorant of the corrosive action of chloride of lime on metal pipes, uses this to mask or, as it is thought, to destroy offensive smells. On close questioning, it is admitted that at times whiffs or even more decided currents of foul smelling gases issue from the perforated opening. The kitchen is in general not only the day room, but the sleeping apartment of some, if not all, of the family. The other, when there are two, is kept and furnished as a better one, with a pride, natural and not in itself wrong, which is regarded as part of the character of Scotch people. It is not unfrequently let to a lodger or two, so as to assist in making up an otherwise heavy rent. In this case, the lodger has the best of it. When refuse, be it animal or vegetable, or merely water which contains this mixed with it, is confined in close tubes and allowed little access to air, it provides a favourable soil for the growth of various low forms of life. These are of the nature of mould, or minute organisms which are on the borderland between plants and living beings. To the healthy these may possibly do little harm. The husband and older male members of the household out all day, with firm muscles and sound tissues, may and do escape unhurt, or not evidently so; but the wife, and especially the children spending unavoidably much of the day in the house, even, it may be, in the kitchen alone, and all night also in the same atmosphere, suffer more or less. We know that certainly two diseases, typhoid fever and diphtheria, and allied to the latter are many sore throats, are produced by foul gases generated in sewers and their connecting pipes. Perhaps, more properly these gases are but the vehicle which carries up some of those minute organisms which, implanted in an unhealthy or weakened body, occasion those diseases. But besides these definite disorders, there are conditions of ill-health which result from the same or similar causes, less decided and less generally recognised. Such are neuralgia, and many disturbances of the stomach and bowels. Too great care cannot therefore be taken, to avoid putting any substances down the sink, or even to wash in its trough any articles, which give off matters, which in the pipes will ferment

and rot, and cause offensive and dangerous gases. It has been said that the offensive smell does not in itself constitute an element of danger, but that it is the warning signal which if neglected, is inevitably followed by mischief. The really poisonous gases are said not to have any smell. Carbolic acid has a powerful effect in checking the production of such poisons, and a tablespoonful of the coarse acid, mixed with a bucketful of water, should be emptied down the sink several times a week. It must never be forgotten that carbolic acid is a deadly poison, and the bottle which contains it should be kept on a high shelf—well out of harm's way.

It is indeed a great pity when the family, from such causes as I have indicated, must sleep in the kitchen. When this cannot be helped, then the sink should be cleaned and flushed, and the room aired as much as possible. These gases steal like the thief at night into our houses, when the air is not much in motion or so often renewed; and we are more open to their insidious attacks, because during sleep our vital powers are lowered and our strength less than in the day, with its active, bustling life, and with its supplies of food.

We are now plentifully supplied in Edinburgh with excellent water, but this may become polluted from various errors in storing it. To one only of these allusion will be made, since it comes directly within the scope of this lecture. On inquiry, it is no uncommon thing to be told that the tenant of a house does not know when the cistern was last cleaned. It is unavoidable that cisterns, however well situated and covered, should become fouled. They must, therefore, be cleaned at stated and known intervals. Sometimes one cistern supplies several families, and a knotty question arises whose duty it is to have it cleaned. All this jealousy should be laid aside; and if the members of one family cannot or will not clean it, the others ought, and without grumbling. In so doing, they not only save themselves from a possible danger and a positive discomfort, but they read their neighbours a valuable lesson. Even indirectly advantage accrues, for were some of the neighbours' household to fall ill in consequence of the bad state of the water supply from this cause,

disease might thus be spread. Water impure from this cause—dirt accumulating in the cistern—is a likely source of those worms which infest children, and even adults, and undermine their health. In cleaning the cistern one caution is necessary—the lead lining must be treated tenderly, so as not to remove that protective coating which forms on it and prevents the water from dissolving the lead, and thus giving rise to symptoms of lead-poisoning oftener than it does. Run off the water; clean the surface with a soft brush gently, but do not scrape the lead.

The subject of food has been already so ably dealt with that I should not have alluded to it had it not been that there is one of its aspects in which it is seldom considered. I refer to the question of what may be termed "likes and dislikes." Taste in diet is capable of almost unlimited extension. We are so constituted that we can accustom ourselves to and finally positively delight in viands which at first may have been absolutely nauseous. It is in this way that it is possible for human beings to reside in almost any region and quarter of the globe, though the materials from which the necessary nutriment of the body are extracted are widely different in flavour, in appearance, and within certain limits even in chemical composition. If then from conditions of necessity, or out of choice, or by determination, we are able to alter our habits in this respect to suit our circumstances, the reverse must also be admitted. We may so cultivate a sense of repugnance for certain articles of diet, that this feeling of disinclination eventually grows and increases, till we are actually unable to eat some one or more of those substances, which are usually classed as foods. A distaste for such articles of diet as are rare luxuries, or unnecessary condiments, or sauces, is of no consequence. But it is far otherwise when we thus expunge from the list of our daily food valuable elements of diet. One, and perhaps the most important, of these is milk. Quite a number of persons cannot, or believe they cannot take milk. All sorts of reasons are alleged for this, which must be an acquired incapacity. Milk has been regarded as a model food. It contains within itself all the ingredients needed for the perfect nutrition of the infant during the first twelve months without any addition whatever,

and all attempts to produce a *thoroughly* satisfactory substitute for it have hitherto failed. Every infant takes more or less milk, and the more rather than the less, the better. If such is the case this disinclination to take milk must have a commencement some time after the earliest period of independent existence. It grows gradually and imperceptibly till it reaches that point, when the individual becomes possessed with the idea that milk is unsuitable or injurious for him or her. The earliest beginning may be mere childish whim, or perhaps medicines have been administered disguised in milk, a plan which should *never* be pursued. Be that as it may, the distaste once permitted to arise in the mind assumes larger and ever larger proportions, and may end by cutting off from habitual use an element of diet which is all but essential during the years of growth, and a valuable adjunct at all ages. This statement might have been even stronger. I have cited milk, but other common and wholesome articles share the same fate. Porridge, eggs, cheese, even butter, sugar and salt, might have been chosen for the illustration. The remedy for this rests in the hands of parents, nurses, and those entrusted with the care and feeding of infants and children. Any expression of dislike to a plain wholesome article of food should be repressed at once with *gentle firmness.* It is unwise to ask children what they would like to eat. The choice of suitable food is the result partly of habit and training, partly of personal experience, and in these children are naturally as yet defective. They should be made to understand that whatever is placed before them for food must be eaten, of course care is to be taken that proper diet is selected for them, and served tidily and neatly. They should be instructed that there are things which their elders can take, which yet are unsuitable for them. In particular, distaste for milk in its simple form, or made into puddings, or for the fat as well as the lean of meat, should be decidedly discouraged. No one can tell in what circumstances his future life may be spent, and it is no slight advantage to be able to partake without discomfort of any plain article of diet. It cannot be too strongly impressed on the mind, that inability to take particular substances, is far oftener acquired than is an innate peculiarity of constitution. Were it necessary,

other proofs of this might be easily adduced. One may offer, however, an explanation of this incapacity to take certain articles. The process of digestion is a complex one, and though in health, all the organs concerned in it act in perfect harmony, some one or other is apt at times to get out of gear, and so give rise to one of the many forms of imperfect assimilation of food, to which the general name indigestion is popularly applied. But, if from any cause our food is defective in one of its necessary ingredients, say fat or oily matter, for example, and this deficiency is perpetuated for a length of time, the gland or organ, whose duty it is to furnish those juices fitted to reduce this particular element of diet to a state in which it can be incorporated into the body not being employed, ceases to act or does so imperfectly. In this way the nourishment of the body is incomplete, and that waste which is constantly going on, is not fully repaired. Thus, the body, on the hand, loses a requisite element of its composition in whole or in part, while the power of digesting this particular substance or compound, fails from lack of exercise, and dislike to it ensues.

In connection with household arrangements, one concluding remark may be made. Economy of time is perhaps, of all things, the most important. Time is certainly more valuable than money. No money can replace time lost or misspent. We all waste time, some more recklessly than others. Method and punctuality are the two great checks on this expenditure. These, too, are valuable lessons and priceless training for ourselves. And these exert over others a power, which acts, silently it is true, but none the less efficaciously. Let us then cultivate by every means in our power, that love of order, which springs directly from being methodical and punctual. And let us all strive to make our homes happy homes, cheerful homes, and holy homes.

THE EAR IN HEALTH AND IN DISEASE.

By R. J. BLAIR CUNYNGHAME, M.D., F.R.C.S.

The ear in health and disease is the subject of our lecture this evening, and I would just mention that, although a small organ, it is, as you are doubtless well aware, one of the most important in the body: it is one of "the five gateways of knowledge," as the five senses were so beautifully designated by the late good and gifted Professor George Wilson.

Many of us may have felt what it is to be but for a time a little dull of hearing, as when after bathing, and especially after diving, we find one of our ears to be what is called stopped up, due to the simple displacement of a little bit of wax in the outer tube of the ear; and although not *deaf*, what intense discomfort it gives rise to until the cause has been removed, either by oneself or a friend, medical or otherwise. When this simple matter causes such annoyance, what must be the feelings of one deaf, or rapidly becoming so, from disease of the ear? "Diseases of the ear are of most frequent occurrence; their consequences are often very serious, affecting the comfort of the patient, his social pleasures, his local relations, his success in business, his intellectual development, and even the duration of life." It is perhaps unfortunately somewhat true that the very frequency of ear disease, and of deafness not very severe, is apt to make any one affected, especially if there be no pain to annoy him, careless in thinking much about the matter, and just letting things take their course. This is a great mistake, inasmuch as all affections of the ear should be attended to at once, because in many cases if this is not done it may be too late when really driven to seek assistance on account of pain in, or discharge from the organ,

more especially perhaps when it becomes offensive and disagreeable to oneself and others, or when deafness more or less absolute has occurred.

The above remarks refer to all, but above all to the young, who we shall see suffer very frequently from affections of this part, more or less serious in their nature, often occurring it may be as the dregs, as it is called, of one of those common diseases scarlet fever and measles; or it may be a result of scrofula, and even a common sore throat or cold in the head is not unfrequently the commencement of dulness of hearing, which may ere long pass into complete deafness, a condition only to be mentioned to enable you to imagine the unfortunate condition of one so afflicted. Still further let us bear in mind that the consequences of ear disease may be very serious to the health, and not a few deaths every year are due to disease of the brain and its coverings, which had its origin in the ear, and which, by a little care and attention paid to the latter at an early period, might have been completely averted. As Professor G. Wilson says, "The ear is in many respects a more human organ than the eye, for it is the counterpart of the human voice; and it is a sorer affliction to be cut off from listening to the tongues of our fellow-men than it is to be blinded to the sights on which they gaze. Those who are born or who early become deaf are far more isolated all their lives from their hearing neighbours than the blind are from those who see. The blind as a class are lively and cheerful, the deaf are shy and melancholy, often morose and suspicious, and naturally so, for our interest in each other far exceeds and ought to exceed our interest in the world, and from all this human sympathy the deaf are almost totally cut off. The deaf, unless they have a great aptitude for such occupations as occupy the eye and hand, are far more narrowed in their circle of studies, and much more solitary than the blind."

Dr Kitto says in his work on the "Lost Senses," while referring to his never having heard the voices of his children, "If there be any one thing arising out of my condition which more than another fills my heart with grief, it is this, it is to see their

blessed lips in motion and to hear them not, and to witness others moved to smiles and kisses by the sweet peculiarities of infantile speech, which are incommunicable to me, and which pass me like idle wind."

Still further let us remember, if the child does not hear when young he is almost sure to become dumb, and if not so serious as this, we should consider that the training of the young mind is greatly hindered by dulness of hearing, and consequently such an one when grown up to manhood runs heavily handicapped in the race of life against his hearing opponents.

We may look upon this subject from another, and perhaps more selfish point of view, inasmuch as all may suffer indirectly from the deafness of others. How many railway accidents may be traced to the fact of an engineman or pointsman being hard of hearing? During 1881 there were in Great Britain 170 collisions between trains, causing death to 27 persons, and injuries to 898, and as the newspaper from which I got the above figures adds, "None of them were of that terribly fatal character which sometimes belongs to accidents of this nature." During the same period 32 passengers were killed when crossing railway lines, and 117 servants of the railway met with their deaths while walking, crossing, or standing on the line on duty; now probably many of these unfortunate persons were more or less deaf. Again, and with more exactitude is the result of the examination made by Drs Lehfeldt and Pollnow of Berlin as to the hearing powers of 160 of the servants employed on one of the Prussian railways, and who found that of this number 34, or more than 21 per cent., or one-fifth of the whole, were more or less affected in respect to their hearing.

Some go the length of saying that few persons escape deafness, and that not many above fifty years of age have their hearing perfect, which is probably not far wrong.

With this introduction let us now pass to the consideration of the anatomy of the ear, after which we will devote a few words to the physiology of sound and hearing, and then pass to the diseases of the ear.

The organ of hearing exists in many of the sub-kingdoms of animal life, in the lower forms being but a simple little organ which enables the possessor only to hear sounds; as we ascend the scale the ear becomes more and more developed and complex, until in the mammalia it has become perfect. In the crustaceæ, as the lobster, the ear consists of a little sac or bag, situated at the foot of the first joint of the smaller antennæ or feelers, it contains a few fine sandy particles, and has the nerve of hearing spread out upon its walls.

In fishes generally we find the vestibular sac present, with, in the higher classes of them, one or more of the semicircular canals. In reptiles, as lizards and serpents, in addition to these we find the small ear bones to have appeared, and a cochlea or snail shell-like bone of simple form; in birds the parts are still more developed and complex, till in mammalia, as we have said, the organ is complete.

In man the ear may be described as consisting of two parts—(1) a conducting apparatus, or the outer and middle ear, and (2) the perceptive part, consisting of the inner ear.

The former consists of (*a*) the auricle or ear of common language, and (*b*) the external auditory meatus or auditory canal, or the outer tube of the ear, which leads from the auricle down to (*c*) the tympanic membrane or drum head. These parts are easily seen, and can be examined and manipulated by the surgeon. Behind the drum head we find (*d*) the tympanic cavity or the middle ear, with (*e*) the ear bones crossing it. (Fig. 1). These various parts receive the sound from without and convey it to the interior or inner ear.

The auricle or ear of ordinary language is in shape roughly that of a funnel, more so, as you know, in animals than in man; it is composed of cartilage or gristle covered with skin. The lobe or lower part is composed chiefly of fat, and usually contains no gristle, an important fact especially to those of the female sex who have their ears pierced for wearing ear-rings, usually a simple operation, and causing no pain or disturbance after the puncture is made, but if, as sometimes happens, a bit of gristle is

in the lobe and is pricked, inflammation is set up and great pain ensues.

The auricle varies much in size and shape in different persons, and may, like the nose, be a family distinguishing point; and a Frenchman goes so far as to say, "Let me see your ear and I will tell you who you are, where you come from, and where you are going." When well-formed and symmetrical the ear is a beautiful addition to the head and face, and Lavater, the great physiognomist, said, "that a white pliant ear of symmetrical and elegant form, with faultless lobe of becoming size, which is nicely attached to the head, can belong to no mediocre individual."

The use of the auricle is to receive, reflect, and condense or intensify sounds which come upon it. This we are constantly proving in our own persons, as, when listening intently to a sound, and especially to a distant one, the hand is placed behind the ear, and that for two reasons, one being to increase its size, and the other to bring it forwards toward the sound, doing with our hand what the lower animals, not having hands, manage by moving the ear itself by means of its muscles. At the same time, the presence of this part is not absolutely necessary for hearing, as it has been cut off as a torture among Eastern people, or lost by accident, and the hearing of the individual so mutilated has not been materially affected. It also affords protection to the inner parts of the ear, and assists in preventing the entrance of dust, insects, &c.

Among savages the ear is a part of the body often disfigured by so-called ornaments, as wearing in them large and heavy ear-rings, which elongate the lobes, and some go so far as to keep various articles of use in slits made for them through different parts of the ear, probably, I presume, not having pockets for holding such, their clothing being but scanty.

Some birds, as the turkey, can stop their ears at will by a kind of valve on the outside, and aquatic animals draw the auricle tightly over or into the opening of the ear, and so prevent the entrance of water when swimming under the surface, a matter in which man should imitate them by putting some cotton wadding into the orifice of the meatus when bathing.

The second portion of the conducting apparatus is the external auditory meatus, or the external tube of the ear leading from the auricle and surface of the side of the head to the tympanic membrane, the so-called drum head. This tube is about one inch

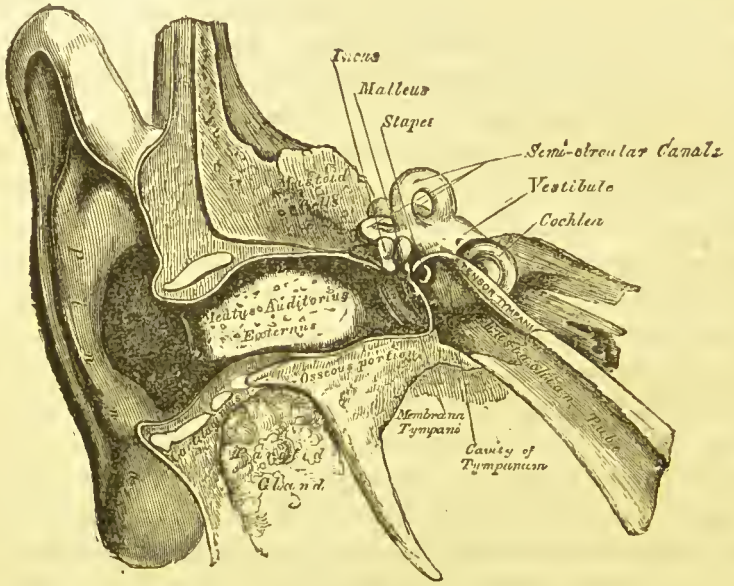

Fig. 1. A front view of the organ of hearing.

Fig. 1 presents a view of a section made through the ear, showing the various parts in position, the auricle—external meatus, or outer tube of the ear, the tympanic membrane or drum head, the small bones, the semicircular canals, and cochlea, with the Eustachian tube.

in length, and is covered with skin, in which we find glands (1000 to 2000 in number) like the sweat glands on the surface of the body, and for the purpose of secreting or forming the ear wax. Towards its entrance hairs grow, evidently for the purpose of guarding the opening against the entrance of things from without. The outer half of this tube is soft and gristly, the inner or deeper half is bony. Now this is important, for as we shall see, children, and even their elders, sometimes put things into their ears, and when, say, a pea has been put in, but little pressure is required to force it deeper, and when past the outer soft half of the tube, it is more difficult to get out, being naturally jammed against the hard walls.

We now come to the drum head or tympanic membrane, (fig. 1), situated at the deeper end of the external auditory meatus, and which separates the middle ear from the tube, and consequently from the air.

The drum head is a little circular membrane or curtain, not unlike gold beater's skin in appearance; it is fastened all round at its circumference to the bone, just as a watch-glass is in its frame. It is easily seen by the surgeon, and its appearance under different conditions is of the greatest use to him in discovering what is the matter with the organ of hearing behind it. Attached to its inner surface is, as we shall see, one of the small bones of the ear.

Beyond it is the cavity of the tympanum, or the middle ear proper (fig. 1). This is a space about the size of a bean, filled with air, and across it passes a chain, as one may describe it, composed of three little bones, one end of it being attached to the drum head, the other to a small foramen or aperture which leads into the inner ear. These bones are the malleus or hammer bone, the incus or anvil bone, and the stapes or stirrup bone, these names being given from the supposed resemblance they present to those three well-known objects. These are joined to each other by little joints, and are so able to move, a most important fact, inasmuch as their becoming fixed, as sometimes happens in diseased conditions, is a cause of deafness. Besides these joints, these bones are provided with certain small muscles, which, by their contraction or relaxation—as you will remember Dr Cathcart explained—enables them to regulate the tension of firmness of the drum head, as also of

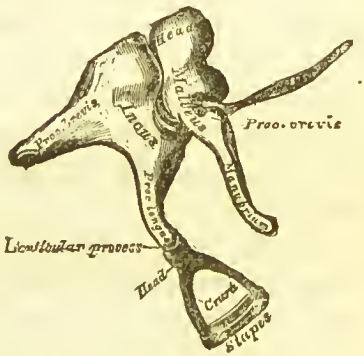

Fig. 2. The small bones of the ear.

The three small bones of the ear, in the position they occupy in the ear — malleus or hammer bone, incus or anvil bone, and stapes or stirrup bone.

the membrane which fills up the opening into the inner ear, and to which the stirrup bone is fixed.

Another important thing in connection with the middle ear is a tube which leads from it to the back of the throat—the Eustachian tube (fig. 1), by means of which air is admitted into this part of the ear, and so provides for the pressure of it being the same on both sides of the drum head, an important point, besides which it gives the cavity a distinctly resonant character. You can easily prove to yourselves the action of this tube; by holding your nose between your fingers so as to close the nostrils, shutting your mouth tight, and blowing, you will or should at once feel the air rush into the ears, and perhaps cause a dullish rustling sound, or even a crack, due to the blowing outwards of the drum head. This has probably not improved your hearing for the nonce, because the pressure of the air upon the inner side of the drum head is greater than on the outer; it is, in fact, compressed air, but on making the movements of swallowing two or three times, you are aware that the air is leaving the cavity again, being sucked out as it were, and the hearing becomes again as it was, the drum head having resumed its former position. This tube is most important, inasmuch as its closure, which is common, is, as we shall see, a great cause of deafness, and what is as important, if attended to soon enough it is usually curable.

Having now shortly described so far the anatomy of the ear, I would say a few words about the physiology of hearing and sound, in order you may the more readily understand the use of those parts we have been considering.

Now what is sound? We may call it "vibrations appreciable to the ear." Physicists or natural philosophers have shewn that the cause of sounds we hear are "vibrations communicated to the particles of air in the neighbourhood of a sounding body. From these it passes to other particles in the neighbourhood, and from these to others still further away from the source of the sound or noise, until the waves of sound, as they are called, strike upon our ears, and we perceive them. This has been

aptly likened to the ripples caused by a stone thrown into still water, which gradually spread from the spot where it entered the water, or to the undulations seen upon a field of wheat when the wind blows over it. The stalks do not pass on, but they each have a certain limited movement to and fro, which helps forward the progress of the wave; and in a like manner the individual particles of air, if we can so call them, push onwards the sound waves, although their own movement is but of small extent.

"All bodies, solid, fluid, or gaseous, are capable of conveying the appreciation of sound to our ears, and it is also certain that the presence of some such body is absolutely necessary for the purpose. This we can prove by placing any sounding body, *e.g.*, a clock, under the bell glass of an air-pump. The sound is heard distinctly, but commence to exhaust the air, and it gradually becomes fainter and fainter as the air leaves the glass, until at last it is not heard at all, although you see the works going all the time; and on letting the air in again, the sound as gradually returns."

Again, you also know, I daresay, that the denser or heavier the air, the better sound is conveyed, *e.g.*, on a cold, still day, a conversation can be carried on at long distances apart, even to a mile in Arctic regions, we are told; and, on the other hand, at high elevations, where the air is thin and light, the voice must be raised when speaking to one even close by.

With this short explanation we are now ready to comprehend the use of the various parts of the ear we have already considered. The outer tube having collected the waves, or oscillations, or vibrations, from whatever source they may have come, directs them down to the drum upon which they impinge or strike, and into which they, as it were, pass, and from it are sent on through the chain of small bones to the oval aperture into the inner ear previously mentioned, where at present we shall leave them. (I., Fig. 3.) Now, from the shape of the drum head, which is slightly funnel-like, these vibrations are intensified at the centre, *i.e.*, the spot where the handle of the hammer is fixed to it, just

as water when poured through a funnel runs more rapidly as it gets into the narrower part of the funnel, and it is proved that on account of this, as also of the lever-like action of the small

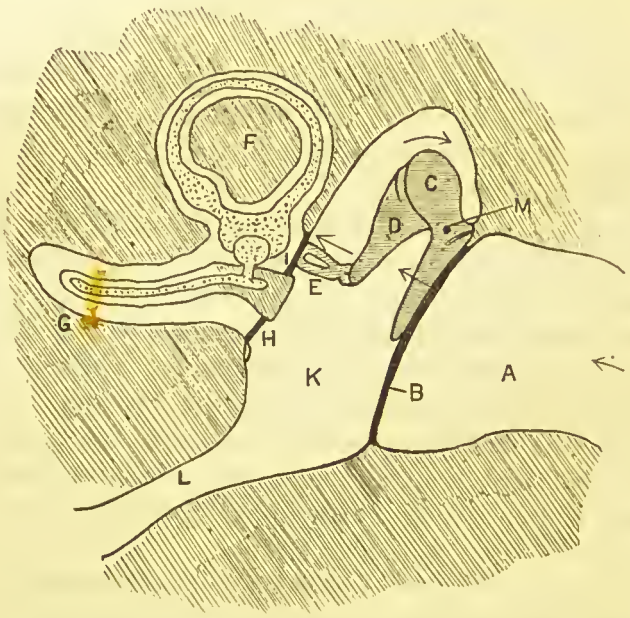

Fig. 3. Diagram to explain the passage of the vibrations from the outer ear to the oval foramen.

The vibrations or waves of sound pass down A, the external auditory meatus, and impinge upon B, the tympanic membrane or drum head. They then pass through the three bones, C, D, and E, the hammer, anvil, and stirrup bones, to I, which is the oval foramen opening into the labyrinth. The arrow heads explain how the bones move. The hammer bone, C, is fixed, as it were, on a pivot at M, whilst its long arm is attached to the drum head B. Consequently, when the latter moves inward, the lower part moves with it to the left, while the head or upper part of the hammer bone moves to the right in the direction of the arrows, and in consequence D, the anvil bone, with E, the stirrup bone, move to the left, and so press upon I, the oval aperture. The reverse of these movements take place when the tympanic membrane is drawn outwards towards A, the external auditory meatus. I is the oval, and H the round foramen, F is one of the semicircular canals, and G the cochlea (unrolled), both in section; K is the tympanic cavity, and L the eustachian tube.

bones, the force of the vibrations or sound waves which pass onwards through or by means of the latter, is increased to twenty or even thirty times by the time they reach the oval aperture. (I., Fig. 3).

Now, what is this apparatus but a telephone, and the waves or vibrations are conducted along it in exactly the same manner as they are along the string which connects the two cardboard

discs covered with parchment—the toy telephones which were sold in the streets by hundreds for one penny.

Sounds vary much to our ears—they may be high or low, shrill or deep, and this is due entirely to the number of, and rapidity with which, the vibrations that are set up strike upon the ear.

According to the philosopher, very low sounds may be caused by only 8 vibrations per second, while very shrill and high sounds, which cause pain to the ear, are caused by as many as 36,500 vibrations per second. We may more easily understand this when we are told that "in organs and pianos the vibrations vary from 33 to 4224 per second, and when these are regular, and with equal and even intervals between them, the sound is a musical one, but when irregular, the sound is discordant, and simply a disagreeable noise is produced.

We now come to the second great division of the ear, viz., the perceptive portion, or the inner ear, that part which is in direct communication with the brain by means of the nerve of hearing, and to which the vibrations have been conducted by the parts just described. This inner ear consists of several most complex and delicate structures (hence being named the labyrinth) which are deeply hidden within, in fact, are excavated out of one of the hardest bones in the body, in order they may be as safe as possible from harm from without, because any, even a slight injury to this part completely destroys the sense of hearing.

A

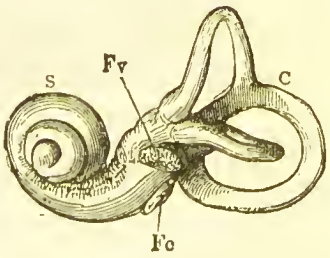

Fig. 70, 4.

Fig. 4. Inner ear.

S, cochlea or snailshell bone; C, semicircular canals; Fv, oval foramen; Fc, round foramen.

Speaking generally, it consists of a series of cavities differing in shape, channelled out of the solid bone, and communicating with the middle ear by two small apertures or foramina as they are called, the oval and round ones. You will remember that it is into the former of these, or rather into the membrane which covers it, that the foot of the stirrup bone is fixed. (I., Fig 3.)

These cavities are three in number. A central one or vestibule or entrance, because the other two open into it, this lies alongside the tympanic cavity, and passing off from it towards the front is the cochlea or snail shell bone, and towards the back we find three bony canals, called semicircular from their shape. They run almost at right angles to each other. (Fig. 4).

Inside the various parts of this bony case is fluid, in which floats a soft or membranous cast or mould of it, as it were, and this in turn is filled with fluid, which is just a part of that which naturally exists in the brain. Upon the soft cast the nerve of hearing ends in very delicate fibres, and it is to this that the vibrations we followed to the end of the chain of small bones are finally conducted, and by means of this nerve the brain is made aware of sounds. These vibrations or oscillations are

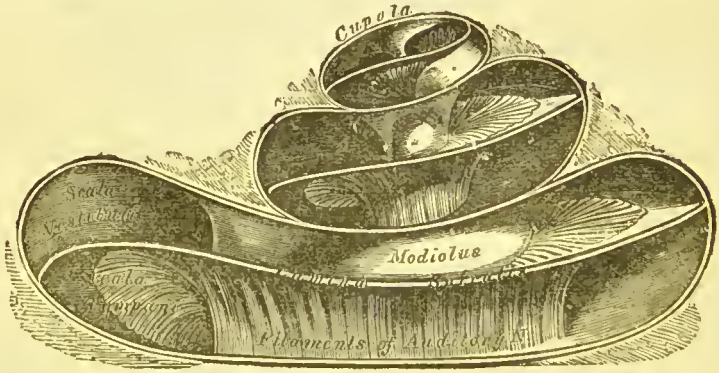

Fig. 5. The cochlea laid open.

In fig. 5 we see the cochlea laid open to shew its structure, which is like that of a snail shell composed of two and a half turns. The spiral cavity is divided into two all the way up by a partition, partly bony and partly soft, lined by the before-mentioned membranous cast, and it is on the soft part we have the nerve of hearing ending in very fine filaments or threads, which apparently terminate in very minute cells.

transmitted through the oval aperture (fig. 4, Fv) to the fluid within the labyrinth, where they in turn cause a similar condition in it, waves, in fact, which are transmitted to the various parts of the interior of that cavity, viz., into the cochlea or shell-like bone and semicircular canals, where they beat upon the minute ends of the nerve of hearing, which terminate in these parts, acting, in fact, like little hammers tapping those ends, causing them to react,

as it were, and sending on the message to the brain, where cognizance is taken of it, and sounds are really heard. (Fig. 5). The object of the second or round opening into the vestibule may now be readily seen. It, like the oval one, is covered by a membrane, and you will at once understand how this prevents injury being done to the delicate nerve ends by the shock of the vibrations or waves in the fluid; it acts as a valve, so to speak, in relieving the pressure, just as when a glass tube is full of fluid, the ends being closed by a membrane, you tap one end the other bulges out, and so prevents excessive pressure being made on the inside wall.

Such is a sketch of the structure of the human ear, and of the physiology of hearing.

We now pass to the DISEASES of the ear, and first those of the *auricle*. This part is not at all unfrequently found to be almost flattened against the head, the ridges and hollows of its surface much obliterated, and the opening into the external tube considerably diminished in size. This is caused by pressure upon the part as by bonnet or cap strings. It interferes with the free entrance of sound, and prevents the proper escape of wax, and is also awkward when the ear requires to be examined, or has to be syringed, the narrowed opening preventing a free view of the parts within. Therefore, do not wear anything over the ears which *presses* upon them.

Growths may occur in the ear due to the custom of wearing ear-rings, and especially when those are of brass or base metal, although gold ones sometimes give rise to the same. Such may become troublesome, and then require removal by the surgeon's knife.

You may remember we stated in an earlier part of this lecture that smart *inflammation* may be set up in the lobe after piercing it for the wearing of ear-rings, should a portion of gristle be there and happen to be transfixed by the needle, and all the more likely should that be a dirty or rusty one. If this occurs the best thing to do is to bathe it well and frequently with hot water, in the hopes that the swelling, &c., will go down; if not, it

will probably suppurate, and will require to be opened by a prick with a knife.

Frost bite may affect the ear even in this country during a hard winter, as the ear is an exposed part of the body and not often wrapped up, and the flow of the blood through it, although ample, as is well seen when it tingles after exposure to moderate cold and is quite red, is not so strong as in other parts which are nearer the heart, the centre of the circulation. When exposed to cold the ear becomes chill very soon, and if the cold be excessive it really may become frozen, appearing white and dead-like, and without any feeling in it. In such a case heat or even warmth should not be applied, else what the doctor calls reaction be set up too rapidly, *i.e.*, the blood returns to it too quickly and in too great quantity, and inflammation ensues, with an almost certainty of the whole dropping off from mortification. In such a case gentle friction with a cold hand or snow or ice is the proper treatment, until the white and dead-like look of it is passing away and some feeling is returning in it, in fact, actual pain.

A *blow* on the ear may cause a great swelling of it, quite altering its shape and appearance, due to the escape of blood into it beneath the skin. This is often seen in pugilists, and is not unfrequently to be noticed in one ear at least of the statues of the ancient Greek and Roman gladiators and athletes, showing how true to reality were the great sculptors of old. Such a condition of course requires a visit to the surgeon, otherwise the ear may be malformed for the remainder of the individual's life.

One form of skin disease, *eczema* or *tetter*, frequently attacks the ear, and when of long standing alters its shape and appearance, besides which it is a painful affection and apt to become chronic. The ear when so affected is red, sometimes moist, at others dry, very itchy, and rubbing or scratching tends only to increase the inflammation and cause the extension of the disease into the external meatus, down which it may pass and ultimately be a cause of deafness. In the early stage, cleanliness, washing with soap and warm water, and the use of some simple ointment, as vaseline or white zinc ointment, applied so as to prevent the

air getting at the affected surface, is probably all that is necessary. When it is more chronic you had better consult your medical attendant.

Pulling the ear, which is not unfrequently done as a punishment to young people, should not be indulged in, as injury may thus be done to the ear and to the outer tube which might have a life-long evil result, or inflammation may be set up in the tissues about the ear. Even disease of the bone to which the ear is attached might in a delicate child be thus induced.

Diseases of the external meatus or outer tube.—Wax or cerumen is a pale yellowish, rather fluid substance, chiefly fatty, which is gradually formed in the same way and by the same structures—glands—as you were told in the lecture upon the skin the sweat was. The wax is only a little thicker, and formed in less quantity.

Deficiency of wax is by many considered a serious thing and a cause of deafness, but not so. It is but seldom a complete want of this exists, and when so, it is due to some other affection of the organ, especially when the eczematous inflammation before mentioned extends into the tube, and causes a dryness, with at the same time itching; and once and for all allow me strongly to impress you with the fact that picking of the ear for this or anything else, as with a pin, toothpick, &c., is very bad, and often the cause of great injury being done to the ear, and even to the drum head, which may be followed by deafness. There are two cavities in the body into which pins should not be put, but into which they too often are, viz., into the ear and mouth. Avoid both.

Excess and hardening of the wax.—When formed in normal quantity it does not accumulate, but is gradually thrown out of the ear in little masses. Sometimes, however, this does not take place, and it collects, becoming dry, hard, and brown in colour, and gradually fills the tube, its exit not having been hastened by the picking it has probably endured, but quite the reverse, this only serving to push it more firmly and deeply in. As long as the tube is not quite filled up it may cause wonderfully little discomfort, but all at once the little chink which is until now left is

filled up, or the plug is pushed down upon the drum head, and deafness at once occurs, because the latter can no longer vibrate with the waves of sound entering the meatus, and it is perhaps accompanied by singing in the head, giddiness, and pain in the ear. When this takes place the individual may consider himself suffering from disease of the brain, when all the time these horrid symptoms are caused by the stirrup bone pressing upon the oval aperture, and vanish at once when proper steps are taken to relieve the cause. This, as you may imagine, is to remove the wax, and for doing it the syringe and warm water alone are the proper things. Of course, before syringing, the ear should be examined and the wax seen, as the above symptoms may be caused by other things than this, and the ear would then not be improved by having a stream of water forced into it and coming rushing against the drum head. A little glycerine and water, or soda in water, dropped in for a night or two are often useful to soften the wax, because it is sometimes very hard indeed, and so permits of its more easy removal.

Foreign bodies frequently find their way into the ears, being either put there by the person himself, as buttons, peas, beans, shells, slate pencil, &c., or may gain access without the permission of the owner, as insects. Sometimes most extraordinary things find their way in, and it was only the other day I noticed in one of the medical periodicals the case of a lady who had suffered much from deafness and throbbing in her ear, and on consulting a doctor he saw a black mass at the bottom of the meatus, which, on removal, he found to consist of a carpet tack, embedded in a mass of clotted blood, wax, and cotton wool. It had been there the patient did not know for what length of time, but for years. This case exemplifies how long suffering nature may be before she resents such a liberty, and at the same time how, when she can stand it no longer, what suffering may result.

Foreign bodies are most frequently put into the ears by children, many of whom have a peculiar pleasure in stuffing small things they pick up into these apertures, or up their nostrils, and is a practice against which they should be cautioned. Now, as a rule,

anything that is put into the ear will come out again when properly treated, but it is most usual in such a case for the mother or nurse when she finds what has happened to endeavour to get the thing out by picking at it with a hair-pin, or other small instrument that may be at hand. You may remember, the outer half of the external tube of the ear is soft and slightly dilatable, the inner half, passing through bone, being hard and resistant, so that the usual result of the endeavour to remove a bead for instance, is to push it in beyond the soft part, where it becomes fast lodged, and soon causes great pain and inflammation. In such a case the proper thing to do is, as with wax, use the syringe. As this little operation is not a severe one, but to be effectual requires to be properly done, let me describe how to perform it. Fill your syringe—a four or six ounce one is best—with warm water, *but not too hot;* take hold of the upper part of the auricle between the thumb and forefinger of the left hand, and pull it gently upwards, by which means you straighten the tube of the external meatus; then place the nozzle of the syringe which is in your right hand just inside the opening into the meatus, and inclining it towards the upper or under part of the tube push down the piston gently, when the water rushes in, and in the great majority of cases gets behind the foreign body and washes it out. If after two or three syringefuls you do not succeed in your desire, try no more, but go to your doctor for assistance, not putting off time, or pain and irritation may be set up, and then the removal will be a much more serious thing.

Insects may get in, as when one is lying on the grass during a warm summer day, and they usually cause great pain by their moving about; but remember they cannot get farther in than the drum head, which prevents their passing into the middle ear, and there is no possibility of their getting into the brain, as is so often imagined and dreaded. The best way to get rid of such an intruder is to fill the ear with water or oil, when he will generally at once back out, or if not, a syringeful of water will wash him out.

Inflammation of various kinds, or rather varying in its seat, may affect the meatus, but we shall only mention one form, viz.,

that of boils, which are by no means uncommon, and are, when present, extremely painful. In this as on other parts of the body several usually occur one after the other. They are frequently the result of the constitution of the sufferer getting below par, or may be due to some cause or other from which he is alone to blame, as exposure to cold. These boils are very small, as a rule, but cause excessive pain in the ear on account of the inability of the parts in the tube to permit of swelling, which is a result of the inflammation about them, and the pain is intensified on pulling or moving the auricle. When this inflammation extends down to the drum head the pain is much increased by coughing, swallowing, etc., which cause movement and pressure upon it from the air passing up the Eustachian tube. The boils may or may not be able to be felt by the tip of the sufferer's finger, this depending upon whether they are situated near or distant from the orifice. To ease the pain, the best plan is to fill the ear from a tea spoon with water as warm as can be borne, and to keep emptying it and refilling it every few minutes; the water cannot get farther in than the drum head, which, you know, closes the bottom of the tube. Another plan is to place a sponge against the ear which has been filled with hot water and squeezed till only steam is left in it. What you should avoid is the application of poultices, as when boils are present such seem to favour their recurrence. Should the above not suffice, the doctor had better be summoned, who will with a very fine knife make a little cut into each boil, which at once relieves the pain, especially if it bleeds freely. Deafness and noises in the head usually attend the presence of boils in the external meatus.

Neuralgia often occurs in the ear, and is accountable for the loss of many a good night's rest. This, with the last, come under the familiar designation of earache, but they are vastly different as to their cause. Here we have no local inflammation, but irritation to some of the nerves of the ear, and generally not at the spot of pain but at a distance; it may be from a bad tooth, or it may be due to the health being decidedly low, when the neuralgia is but a sign of this, and is cured by the use of proper food and other remedies. As a rule there is no deafness or noises

in the head, and if a tooth be the offending cause, I recommend a visit to the dentist.

Proceeding deeper, we sometimes find *the tympanic membrane inflamed,* a condition that occurs occasionally after bathing and diving when the cold water has gained access to the ear, especially in those who have a large and straight tube; and bearing this in mind it is a proper precaution to guard the ears when so employed by placing a little bit of cotton wadding in them, which will prevent the free entrance of water. As before mentioned, when the drum is inflamed the pain is increased by coughing, sneezing, swallowing, etc.

The drum head is sometimes injured or ruptured by its close exposure to sudden loud sounds, *e.g.*, the firing of heavy ordnance, or even of a gun when close to the ear. Another cause is being in compressed air, as may happen to those employed in sinking the piers of bridges, where air is used to expel the water from the cylinders. Blows on the side of the head with the palm of the hand may do the same, as also other injury should the ear be unsound at the time, which form of punishment, therefore, never apply to a child, but if such be absolutely necessary, and I do not really think it often is, go lower down where no permanent injury can be done, and the good effects will be the same. The reason why rupture of the drum head may be caused by these various things is that the air in the external meatus is suddenly compressed and strikes the drum head with great force, and this part either being unprepared does not yield to the pressure (for we all know how when expecting to hear a loud sound our ears are somehow felt to make ready for it), or owing to some obstruction to the Eustachian tube, the air cannot be driven out of it into the mouth with equal force to that with which the outside air strikes the drum. The artilleryman accordingly opens his mouth a little when his gun is fired, and so permits of the pressure being equalised on both sides of the tympanic membrane. The rupture, if simple, will probably give rise to little or no future evil result, as the wound heals readily, but if the sense of hearing be injured by the concussion, which it sometimes is, deafness and noises in the ear often result and remain during the life of the individual.

In connection with this I may mention that in some noisy trades, as boiler-makers, rivetters, &c., deafness is apt to come on, but here probably more often due to a form of chronic inflammation set up in the inner ear than from immediate injury to the drum.

A not unfrequent cause of injury to this membrane is picking the ear with a pin, knitting-needle, or something of the kind. When such an accident happens the best thing to do is to leave it alone, put no drops into the ear, for they will probably go further than wanted, only a bit of cotton wool into the opening of the meatus to prevent things from the outside getting in, when the wound will usually heal, and that is the best result to be desired. Of course if the injury has been done with force as from the jog of an elbow when one is picking the ear, or from a thorn when going through a hedge when hunting, or lying down upon a straw, and such penetrate deeper into the inner ear, irreparable damage is probably done at once.

Middle Ear.—We now come to perhaps the most important of the diseases of the ear, inasmuch as they are very frequent, arise from several causes, are often very chronic, and not unfrequently very dangerous, even causing the death of the sufferer. I shall only mention a few of the more important, and first, the so-called *running ears.* In this affection you have a more or less constant discharge from the ear of a mattery-like fluid, often with a horrible smell, frequently causing no pain, and consequently in too many cases not considered of much importance except it be the dulness of hearing which may be present. The disease is situated deep in the ear behind the drum, or more correctly perhaps where the drum once was, as it is now gone either in whole or in part, and often the small bones with it. When you are told further that the space is but small in size, and not far distant from the brain, you can readily imagine how the inflammation—for it is inflammation that we have to deal with, though not perhaps acute or sharp—can and does spread to that most vital organ in some cases, and causes the most dire results. One of the most common causes of this condition is scarlet fever, and it is one of the so-called dregs of this disease, as also of measles. It usually begins during the course of the fever, and is more apt to occur in

the person of a delicate child than in one who is strong, in fact, among such as Johnny, who you will remember Professor Maclagan described so vividly as being brought up in rooms, particularly his sleeping apartment, with too limited cubic air space, but all the same it is by no means confined to those. Whenever any of your children may be suffering from this fever, note carefully if he or she complains of pain in the ear or head, and draw the doctor's attention to it, or possibly the first sign you have of anything being wrong with the ear is that you notice a little discharge on the pillow, which at once have attended to, or the chances are your child may be deaf for life on one or both sides, or may even die in a fit from the irritation caused by the pain.

Another result of this inflamed condition of the middle ear is the growth of fleshy-looking lumps, or *polypi*, as they are called, sometimes small, at other times so large as to project from the orifice of the external meatus. For these you must consult a doctor, as they require to be removed. By attending to the above cause of them, you may often save yourself or your child, for they occur at all ages, from the pain of an operation, which, however slight to the surgeon, no one likes to undergo. Another result of this same inflammation may be paralysis of the face. Above all, never be convinced by any one that you or your child will grow out of this state of running ears, nor that the so-called drying up of them is bad. In the treatment of these things, the chief point is cleanliness. The ears should be gently syringed out two or three times a day with tepid water, putting a little Condy fluid or a pinch of soda into it; the former is advisable when the smell is bad, the latter when the discharge is thin and curdy-looking, as it helps to loosen and dissolve the masses of matter, which, if they remain in the ear, become very fetid and cause an increase of the irritation and mischief. Drops of various kinds may or may not be of use after the washing, but before venturing to use such ask advice, or you may do more harm than good.

When the tympanic membrane is partially or even wholly gone, the use of an artificial one in the form of a specially-made imitation drum head, or of a little bit of cotton wadding pressed down to where it was, may improve the hearing.

The most common cause of deafness, and it may occur to all and at any age, *is due to the result of a cold*, perhaps neglected as not being of much consequence at the time. The cold, or catarrh as it is called, has attacked the throat and nose, causing a dryness, followed by an excess of moisture about the parts; when in the nose it is the popular cold in the head or running at the nose. Should this continue, the mucous membrane, *i.e.*, the pinkish lining of the nose, mouth, &c., becomes thicker than natural, and the same condition spreading up the Eustachian tube, results in its becoming more or less closed, simply from the swelling, and in consequence air cannot pass freely up it from the mouth to the middle ear. You will remember what now occurs; the air in the cavity disappears or is absorbed, and the drum falls inwards, from the pressure upon its outer surface being greater than that upon its inner, and this being continued to the stapes or stirrup bone through the other two, it presses harder than it should upon the oval aperture, and through that on the fluid in the labyrinth, which, by interfering with the nerve of hearing, causes deafness, noises in the head, giddiness, &c.

Fortunately this form of deafness, when simple and not of long standing, is easily curable; and it is a pleasure and satisfaction to see the face of one who, a moment before, was deaf, after the slight manipulation of filling the middle ear with air again, hears perfectly. You can often do it for yourself, by holding the nostrils, shutting the mouth, and blowing, when the air is forced up the tube, and at once you perceive a flap or noise in your ear, due to the drum head going back into its proper place, and as long as the air remains in the ear cavity, so long does the hearing. This, however, may not suffice if the affection be of some standing, when the aurist has to be consulted, who, by means of a small tube passed up the nostril and into the mouth of the Eustachian tube, is able to blow air into the tympanic cavity. Do not, therefore, neglect a cold in the head or throat, thinking it does not much matter, as it, among other evil results, may be a cause of deafness.

Nervous deafness.—True nervous deafness, due to disease of the inner ear, labyrinth, or nerve of hearing, is fortunately not at

all a common disease, because it is quite incurable ; but some of the symptoms, the presence of which might indicate that these parts are affected, are common enough, and due to other causes, as dizziness, staggering walk, and deafness. The giddiness may be owing to a bilious condition, or to the pressure upon the drum of wax ; deafness to any of the various things we have considered, and all may be caused by the taking of quinine. When a person is absolutely deaf to all sounds, even when directly conducted into the ear—as by a tube, or through the bones of the head, as when a tuning fork is sounded upon them—then we must regard the incurable condition as present. Among the causes of this nervous deafness may be mentioned injury to the ear, as from a severe blow on the side of the head, the concussion caused by the close vicinity of very loud sounds, spread of inflammation from the middle ear through the windows or foramina, and it may also be a result of severe fevers of various kinds, and of inflammation of the membranes of the brain. As to treatment, nothing, I am afraid, will avail as a cure in true nervous deafness.

Deaf mutism may be, generally speaking, due to a born or congenital condition of deafness, not, however, very common, for how few infants do we come across who are not easily awakened by noise ; or it may be the result of disease occurring during infancy or childhood. In the first case, parts of the organ of hearing are awanting, as the labyrinth, cochlea, or semicircular canals ; in the latter these parts are so altered by disease as to be useless, as occurs sometimes after scarlet fever, or long closure of the Eustachian tubes.

How do you discover whether your child be quite deaf or not ? In the first place, a mother generally has her suspicions when her infant does not respond to her caresses, and especially does not look towards her when she speaks to it ; but all the same she hopes against hope that in time, when a little older, it will act as others. When this does not come about she takes her child to a doctor for his opinion, and the test is simple enough, viz., to make a loud noise, as ringing a bell, close to the infant, but not permitting it to see you, and if no notice be taken, *e.g.*, not turning its head toward the sound, you can only say, deaf. At

the same time, when a door slams the child may take notice of it, not because it hears, but because it is very sensitive to vibrations, which are conducted to it through the floor.

The great point now is how best to educate such a child, and this is done in two ways:—one, by teaching it to converse by means of its fingers, as you have all seen; but this is limited in its use, because they can only converse with those in this way who can do so likewise.

In Germany, Sweden, America, &c., another plan has existed for a good long time, and is now well known in this country, viz., labial or lip speech, in which the child is gradually taught to look at the lips of one who is speaking aloud, and note the various positions the lips and tongue take when speech is made, and getting them to imitate, which a child of average intelligence will soon do. After a little while, by showing pictures, models, &c., the child is trained to speak though hearing not, and can carry on a conversation with another by looking simply at his mouth, and that so well that one author states from his observations that in a certain proportion of such one can hardly discover the speaker to be deaf, and that a considerable proportion of the remainder manage well enough for carrying on the ordinary work of life. The pronunciation of these is certainly somewhat peculiar, but that is nothing if one can make them useful to themselves and others.

In conclusion, I would just show you a few of the more usual ear trumpets, or instruments for assisting those who are partially deaf to hear. They all owe their power to their shape and to the material of which they are made (metal), for, like the speaking-trumpet used by mariners, they collect sounds by means of their wide mouths, and reflect them from side to side as they pass down to the small end, which is placed in the ear. These are increased by their cavities being resonant, which always intensifies sounds. Some of these are for hearing a speaker at a distance, others when close at hand, in fact, speaking directly into the tube. Their shapes are various, and each should suit himself to that form which affords most assistance.

THE EYE: THE ORGAN OF VISION.

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The subject to which I desire to direct your attention this evening is so wide in its scope that I shall only be able very briefly to allude to some points upon which I might with advantage dwell more fully, and to omit entirely the consideration of many of considerable importance and of no little interest, but for the discussion of which the time allotted to such a lecture as this would prove much too short. All that I can hope to do is to give you a very general idea of the structure of the eye, to point out its exquisite adaptation to the function of vision, and to give a few hints as to the best means of preserving the sight.

I must at the outset claim your kind indulgence should I fail to make the whole subject perfectly clear and intelligible to you all, as some of the points to which I may have occasion to refer are perhaps rather more intricate than is common in a popular lecture, but without allusion to which justice could not be done to the beautiful structure of the eye.

It is by the aid of our senses that we are in communication with the external world. By them we are made aware of the qualities and conditions—nay, the very existence of the various objects by which we are surrounded, and which impart pleasure to our life. Our senses constantly gather from all quarters information, which they by special nervous channels convey, or telegraph as it were, to our brains, there to be read by the mind and used as it may direct.

These senses are five in number—sight, hearing, touch, taste, and smell, and each resides in an organ or set of organs wondrously adapted to its requirements. Without them we should have no knowledge of our own physical nature, or of the objects beautiful and varied by which we are surrounded; we should be unable to communicate with our fellow-men; we should be bereft of all intellectual power; but I should fail to describe what we may vainly attempt to conceive—the utter blankness of our condition, if we possessed not these faculties. It is to them we are indebted not only for a knowledge of what falls under our own direct observation, but for that vast sum of human information which their exercise during 5000 years has slowly accumulated.

But of all these senses I claim for sight the foremost place, and that on many grounds of which I may indicate but a few. It stands pre-eminent, 1st, in respect of the *extent* of the field with which it brings us into relation. Let an object lie anywhere between a few inches from our eye and a distance utterly beyond our conception, and we can by an effort, of which we are scarcely conscious, bring ourselves into relation with it. Let it be so vast that our minds cannot realise it, our eye will nevertheless take it all in and figure it with the greatest precision. Let it be so minute as to be beyond the ken of our other senses, the eye will still mirror it to perfection. If we call instruments to our aid, we can examine the general form and arrangement of objects the most distant, and the most minute structure of those within our reach.

It stands pre-eminent, 2dly, because of the *variety* of information which it directly conveys, for it tells us at once of form, distance, size, colour, number, and texture.

It stand pre-eminent, 3dly, on account of the *rapidity* with which information is brought to the eye and appreciated by the mind, the process being almost instantaneous.

It stands pre-eminent, 4thly, by the *very wonderful structure* of the organ in which it resides—a structure which it is one of the chief objects of this lecture to explain to you.

Besides such direct evidences as these I may for a moment

advert to some implied proofs which we find in common language, in Holy Writ, and elsewhere. I believe in all languages the expression "to see" is employed as synonymous with "to understand or comprehend," which is not the case with any of the other senses. Thus we express the noblest function of the human mind by the use of the figure "seeing," while feeling and taste, and even hearing, are applied to lower attributes. And I think we may be warranted in saying that a greater nobility belongs to sight than to the other senses when we observe how God in ancient times revealed Himself always through other organs, while it is expressly declared that no man shall *see* Him and live. In his great creative work, too, one epoch was marked by the formation of that matter, or rather quality of matter, which is appreciated by the eye alone, when God said, "Let there be light." I do not desire to depreciate the value of the other faculties we possess while I vindicate the superiority of sight, but I am anxious you should have a just appreciation of the wonderful gift God in His goodness has granted in the sense of sight.

The late Dr Thomas Reid, the eminent professor of Moral Philosophy, thus expressed his opinion on this point. "Of the faculties called the five senses, sight is without doubt the noblest. The rays of light which minister to this sense, and of which without it we could never have had the least conception, are the most wonderful and astonishing part of the inanimate creation." "If," he further remarks, "we should suppose an order of beings endued with every human faculty but that of sight, how incredible would it appear to such beings, accustomed only to the slow informations of touch, that by the addition of an organ consisting of a ball and socket of an inch diameter they might be enabled in an instant of time, without changing their place, to perceive the disposition of a whole army, or the order of a battle, the figure of a magnificent palace, or all the variety of a landscape? If a man were by feeling to find out the figure of the Peak of Teneriffe, or even of St Peter's Church at Rome, it would be the work of a life-time. It would appear still more incredible to such beings if they were

informed of the discoveries which may be made by this little organ in things far beyond the reach of any other sense; that by means of it we can find our way in the pathless ocean, that we can traverse the globe of the earth, determine its figure and dimensions, and delineate every region of it; yea, that we can measure the planetary orbs, and make discoveries in the sphere of the fixed stars. Would it not appear still more astonishing to such beings if they should be further informed that by means of this same organ we can perceive the tempers and dispositions, the passions and affections of our fellow-creatures, even when they want most to conceal them? That when the tongue is taught most artfully to lie and dissemble, the hypocrisy should appear in the countenance to a discerning eye? and that by this organ we can often perceive what is straight and what is crooked in the mind as well as in the body? How many mysterious things must a blind man believe if he will give credit to the relations of those that see? Surely he needs as strong a faith as is required of a good Christian."

The eye is further one of the most expressive features of the human countenance. I am aware that this is a view that does not meet with universal acceptation. Thus the late much respected Principal of the Edinburgh University, Sir David Brewster (whose views most justly carry great weight with men of science), in one of his inaugural addresses to the students at the Edinburgh University, in referring to some, perhaps extravagant, laudations of the power of expression in the human face enunciated by Prof. Carus, remarked, "There is no expression in the human eye, consisting of a transparent cornea, a coloured iris with the pupil in its centre, and the white sclerotic coat. You may as hopefully search for expression in a watch-glass as in the cornea, as hopefully in a coloured wafer with a hole in the centre as in the iris, and as well in a piece of white kid leather as in the sclerotic coat."

In pleading against this opinion, I would appeal to the universal experience of man; for who is there that is not accustomed to judge of the characters of strangers whom he may meet, or the

state of the mind of friends by the expression of the eye? and do we not find in common acceptation the terms noble, fierce, greedy, cunning, haughty, modest, intellectual, &c., applied to the eye? and does not the Poet Laureate speak of a sensitive man being "gorgonised with a stony British stare?"

Is it possible that so many common expressions should exist if the eye were a dull meaningless ball? or that it should be so universally accepted as an index of the inner man if it were not really what I claim for it—one of the most expressive features of the body?

I acknowledge it may be argued that, admitting the expression to exist, it resides more in the eyelids and other appendages than in the eye itself, and there is a considerable amount of force and truth in this assumption; but where, let me ask, is the expression of an eye disorganised by disease, or who ever heard of the language of a glass eye? It is told of a gentleman whose public position led to his being frequently examined as a witness before Parliamentary Committees, and who having had the misfortune in early life to lose one of his eyes had replaced it by a glass one, that in his examination in chief, when expounding his own views, he turned the full light of his rich expressive eye upon the members of the Committee, but when cross-examination began he fixed upon them the dead dull stare of his glassy organ, with the effect, it is said, of greatly discomposing his adversaries.

Having said thus much regarding the importance of our subject, I shall now endeavour to explain to you the structure and functions of the eye. But let me first for a moment direct your attention to the position of the eye. We observe that it is placed in the upper part of the body, by which arrangement we are enabled to see above numerous small objects, which, if the eye were situated on a lower plane, would limit the extent of vision. We may also observe that the eye is placed in a bony socket, which serves in a most efficient manner to preserve it from most forms of external injury, the eyebrows, nose, and cheek standing forward to ward off any blow. Let me suppose for the sake of illustration that the eye were situated in the leg, how continually would it be exposed

to the danger of blows from small objects, which in its natural elevated position it is free from, and how contracted would be our range of sight; every paltry bush, every good-sized stone would intercept the line of vision, and thus our sight would generally be limited to a small circumscribed spot in our immediate vicinity. Thus we see even in the position chosen for the reception of this important organ an illustration of the wisdom of the Creator.

Let us now consider the structure of the eyeball.

The eye is a hollow globe or sphere within which are contained various structures entering into the mechanism of vision. This globe or sphere is composed of three coats or coverings, each of which differs in structure from the other and serves a different purpose.

The outermost of these coats is thick, tough, and elastic, and is in particular the protective covering of the eye. It is it, moreover, which imparts to the white portion of the eye its beautiful colour. This coat is termed the sclerotic. Within this coat we find what may be viewed as the nutritive coat, as it is richly supplied with blood-vessels, by which the waste occurring in the various tissues of the eye is mainly supplied. But besides blood-vessels, this coat contains a thick layer of a black substance, to which we apply the term black pigment, the use of which is to absorb those rays of light which pass through the innermost coat, and which if not absorbed would render vision confused and indistinct.

The innermost of the three coats of the eye, and which we may call the sensitive coat, ranks certainly as the most important of the three, for while the other two may be said to be merely accessory to vision, this is the one through which the impressions of external objects are conveyed to the brain. This coat is termed the retina. It is in part composed of an expansion of the optic nerve, or nerve of sight, to which, however, there is superadded certain delicate structures sensitive to the impressions of light, the fine extremities of the nerve of sight serving mainly the function of conveying a sense of these impressions to the brain, our great percipient organ.

The arrangement of these coats deserves a passing word of notice. The firm protective coat is placed externally to ward off injuries, the nutritive coat is conveniently placed centrally, while the delicate, finely-organised structure needed for the sensitive coat occupies the innermost place, furthest removed from injurious influences.

These are the coats of the eye, but it is evident that if these coats were completely continuous, the rays of light could not obtain access to the sensitive innermost coat of the eye, which is essential for vision; and here we observe a beautiful provision of nature in an alteration in the structure of the protective coat at the front part of the eye, its thick dense opaque structure being replaced by an exquisitely clear transparent substance, possessing, however, great firmness, termed the cornea. The choroid and retina, too, do not extend so far forwards. The cornea may be viewed as the window of the eye, and serves the two purposes —of permitting the passage of the rays of light into the interior of the eye, while at the same time it serves as a continuation of the protective coat.

Let us now glance at the structures contained within these coats. Within the window of the eye we perceive a structure which may be viewed as the curtain of the eye. It is a thin membrane of circular form, having in its centre an aperture—the pupil. From the variety in colour which this membrane presents in different individuals (blue, grey, brown, or black) it has received the designation of the iris or rainbow. It is by it that the amount of light admitted to the interior of the eye is regulated; and just as we draw the curtains when the sun is shining into a room with painful brightness, or withdraw them as the evening advances, so does this beautiful curtain, independent of any effort on our own part, contract or expand according to the intensity or feebleness of the light. The power of dilating and contracting the pupil resides in two sets of muscular fibres (or contractile bands or strings), one set being arranged circularly round the pupil, the other passing in a radiating manner (like the spokes of a wheel) outwards from the

pupil. The first set act like the string round the mouth of a bag, and when they contract draw the iris towards the centre, thus lessening the size of the pupil. The other set, on the contrary, when they act serve to draw the iris from the centre, and thus increase the size of the pupil.

It is extremely interesting to watch how exquisitely this arrangement acts, which is readily done by placing the subject of experiment in front of a window or otherwise in a good light, and shading his eyes by covering them with the hand for a few seconds. The pupil while the eye is thus shaded becomes much enlarged, but the moment the covering is removed contracts with great rapidity.

Situated behind the iris is the crystalline lens, a beautiful clear magnifying glass suspended immediately behind the pupil. The round white ball which many of you I daresay have noticed in the eyes of boiled fish is this structure, the crystalline lens rendered opaque by the process of cooking. In health it is, as I have said, transparent as the finest crystal, but in some people as age advances it becomes hazy, and eventually opaque, constituting the condition termed cataract. Between the lens and the cornea we have a fluid termed the aqueous or watery humour, which differs little in composition from pure water. The space behind the lens is occupied by what receives the appellation of the vitreous (or glassy) humour. In appearance and consistency it very much resembles a thin, clear, colourless jelly.

I have now, I hope, given you a general idea of the structure of the eyeball, and shall next direct your attention shortly to the mechanism by which the eye is moved.

As it is necessary for perfect vision to direct the eyes towards any object we desire to see, we find in nature two modes whereby this is effected with the least degree of inconvenience. We observe abundant illustrations of the one method in insects, some of which possess a great multiplicity of eyes. Thus we find the spider provided with eight eyes arranged in a circle round its head, and so placed as to enable it to look in all directions. In

the working bee there are above 3000 eyes, in the beetle above 6000, and in the common house-fly 8000, which are arranged in two large groups placed on either side of the head. In these animals the eyes are fixed, and hence the necessity for the number they possess, by which means they are enabled without moving to see on every side of them. In man and the higher animals, however, we find the number of eyes reduced to two, but to compensate for the want of number they are endowed with motion, whereby we are able at will to fix our eyes on any object. This result is effected by means of what are termed muscles or bands of fibres, which (like those we described in the iris) under the influence of nervous force contract. The muscles by which the eye is moved are six in number—one serving to raise or elevate the eye, one to depress it, one to turn it to the right, one to turn it to the left, while the two remaining muscles roll or rotate the eye, as it were, on a central pivot. The first four muscles are all attached to the back of the *orbit*, or bony cavity in which the eye is lodged, and passing forwards over the eyeball are attached to it close to the edge of the cornea. It is evident that by their alternate contraction the eye will be elevated and depressed, and turned to one side or the other, and that by the simultaneous action of two neighbouring muscles the eye may be turned in any intermediate direction. The use of the other two muscles that roll the eye was at one time the source of much diversity of opinion, but it appears now to be universally accepted that these muscles enable us to see objects upright, even when the head is held in a slanting direction.

There are still some structures which, though not constituting parts of the eyeball, yet are of essential consequence to its preservation, and thus require mention at our hands.

It must be manifest to all that were so delicate an organ as the eye exposed to the contact of dust and other irritating substances, which are always to a greater or less extent suspended in the air, mischief to the eye would infallibly soon result—the transparency of its clear structures, which is essential for sharpness of vision, would be interfered with, and, like the view we obtain of objects

through a very dirty window, we would be almost as much embarrassed as aided by the distorted and indistinct image we would thus obtain. To cover and protect the front of the eye and to close it from the access of light during sleep we are provided with eyelids, which may be viewed as the shutters which cover the window of the eye. The eyelids not only protect the eye from dust and other causes of irritation, but also serve an important purpose in directing the flow of tears over the surface of the eyeball, which moistening of the eyeball is not only essential for the preservation of the transparency of the clear texture of the eyeball, but also permits the lids to glide with the most perfect smoothness and freedom from friction over the surface of the eye. The edges of the lids are fringed with eyelashes, which ornament the eye, but also serve to prevent small insects or larger particles of dust from coming in contact with it.

The tears which I have alluded to as essential for the lubrication of the lids and for the preservation of transparency in the clear tissues of the eye are secreted (that is to say, extracted from the blood) by a structure termed the lachrymal gland, a body consisting of a number of very minute vesicles or bags, which have the power of extracting from the blood circulating in their walls a watery fluid—the tears—which is collected in the interior of the bags, and from them conducted by ducts or tubes on to the surface of the eyeball. This gland is situated above and to the outer side of the eyeball, and the tears partly gravitate and are partly directed by the lids to the part of the eye next the nose, where they are again taken up by two small ducts, which convey them into a larger tube, by which they are conducted to the nose.

To prevent the tears passing over the lids, we perceive a beautiful contrivance in the presence of a row of small glands on the inner surface of the lids, by which a greasy substance is secreted, which, greasing the edge of the lids, arrests the flow of the tears. In the healthy eye, it is only when it is exposed to some irritating cause, or when the mind has been affected by some strong emotion, that the greasy line fails to prevent the passage of the tears over the edge of the lid on to the cheek.

Having thus shortly described the more important of the textures that are concerned in the function of vision, let me now briefly advert to the adaptation of all these structures to the sense of sight.

In every organized being we observe a distinct susceptibility to the influence of light. We see the sunflower revolve its head towards the sun, the daisy and unnumbered other flowers open their blossoms in the morning to the light, and close them as the shades of evening fall. We see animals of the lowest type increase in activity as the light of the sun falls on them, and the sea anemones at the bottom of the rocky pools open up under its influence. But as we pass up in the scale, a higher organization demands, in addition, special organs for receiving its impressions.

In many little more is required than an organ capable of distinguishing light from darkness, and accordingly the simplest structure suffices for their wants. The worm, for example, which in its earthy habitation would find good eyes rather an encumbrance, is provided with a few little knobs of sensitive, nervous matter which amply serve its purpose, while the higher creatures require and therefore possess a more perfect mechanism. In the highest animals we find the eye developed into a very perfect optical instrument.

But to explain its mechanism, it is necessary that I should make a few explanatory remarks respecting the nature and direction of the rays of light by which we see. Some may here remark that light is not essential for vision, inasmuch as some animals see in the dark. This, however, is a statement founded on error, a popular fallacy, as *no* animals can see in the dark. Some, especially animals who seek their prey by night, are possessed of very sensitive eyes, and see remarkably well when the light is very dim, and like the owl or bat, dazzled by the bright light of day, seek during sunlight some dusky habitation. But where light is absolutely excluded, there sight too is abolished.

Rays of light then may, for one purpose, be divided into two classes—*first*, those proceeding from a source of light, as those

from the sun or moon, or from the flame of a lamp or other artificial source of light; and *second*, those rays which are reflected from the surface of material objects. It is by the passage of this latter class of rays to the retina that we obtain an impression of the object from which they were reflected. But it is not merely necessary that these rays should strike the sensitive coat of the eye, but also that they there should form a distinct image of the object from which they proceed. To obtain this distinct image, the rays of light which, as they proceed from the object, are divergent (or spread out), must be so altered in direction as to come to a focus, as it is termed (that is to say, to meet at a point), on the surface of the retina. To bring this about, some of the structures I have already described are brought into use. The divergent rays of light, in passing through the cornea, are by it sensibly changed in direction, which alteration in their course is much increased by their passage through the lens, the result being that they become gradually approximated, till eventually they meet at the retina, and then form an exact though inverted image of the object from which they proceeded.

We find, however, that rays are not always equally divergent, but that the nearer the object is to the eye the more divergent are the rays that pass into the eye, and that, consequently, to bring rays of different degrees of divergence to a focus at the same point—viz., the surface of the retina, we require a means of altering the power of the lens according to the distance at which the object is which we desire to see. This is accomplished by a muscle of a circular form, situated opposite the margin of the lens, which, by its greater or less contraction, increases or diminishes the power of the lens. This power of adapting the eye to different distances is termed the power of accommodation or focussing, and the muscle that affects the alteration is called the muscle of accommodation.

To render this somewhat intricate subject a little more clear, allow me to compare the eye to an instrument framed in imitation of it—the photographic camera. The wooden frame of the instrument blackened on the inside represents the outer

and middle coats of the eye, the brass tube with lens in front are counterparts of the cornea and crystalline lens, while the ground glass plate at the back of the instrument represents the retina. If we watch the photographer's movements, we may observe him, after carefully directing the front of the camera to the object to be photographed, stretch his hand forwards towards the brass tube, and by a few turns of a screw, satisfy himself that he has on the plate of ground glass the most sharply defined image of the object he can obtain. The screw in this instance corresponds to the muscle surrounding the lens in the eye, and according to the distance of the object to be pictured, so has the photographer to give the screw a few turns backwards or forwards. And as we often see blurred or defective photographs, which, upon enquiry, we learn are due to the object being "out of focus," so should we, were we deprived of the power I have described, obtain but dim, ill-defined images of surrounding objects.

It is interesting to notice the changes that occur in the shape and texture of the lens with advancing years. In infancy the lens is very much curved and of soft consistence, but as age advances it becomes more and more flattened, and much more dense and unyielding in structure. Thus it happens that it is much less easily acted on by the muscle of accommodation, the result being, that while the eye is capable of producing sharp and well-defined images of distant objects, near objects cannot be distinctly perceived. This is the condition of aged sight, which necessitates the employment of spectacles with suitable magnifying lenses, for reading, writing, sewing, &c.

But the eye appreciates not merely the form of an object, but also that infinite variety of colour with which the Almighty has enriched and beautified the works of His creation.

It has been frequently debated whether this, the perception of colour, is in all respects a natural gift, or whether it may not, in part, at any rate, be the result of education; and our undoubtedly able and versatile Premier, Mr Gladstone, has favoured the latter view, mainly from the circumstance that Homer, the Greek poet,

has in his works spoken of the colour of objects in a very indefinite and inaccurate manner. Thus in his Juventus Mundi (page 539), Mr Gladstone says:—"To us of the present day, colour and its broader distinctions are familiar from childhood upwards. But in the first place, it is to be borne in mind that the acquired knowledge of one generation becomes in time the inherited aptitude of another. In the second place, much of our varied experience in colour is due to chemistry and to commerce, which brings to us the productions of all the regions of the world. Mere nature at any one spot does not present to us a full and well-marked series of the principal colours, such as to be habitually before the mind's eye. Thirdly, the curious investigations of late years have shown us that, even now and in our own country, no inconsiderable proportion of persons are without the faculty of perceiving some of the primary distinctions of colour."

I cannot but think that Mr Gladstone does not show much judgment in taking a poet's descriptions as evidence of the power of perceiving colour that prevailed among educated people at his time. Poets have had very considerable licence allowed them in the employment of figurative language at all periods of the world's history, and the exactness of their language in the description of material objects is not to be trusted. And even although one might conclude that Homer did not perceive colours correctly, it were certainly a rash inference to arrive at that a similar failing prevailed among all educated people of his time. The circumstance that colours are correctly employed in Old Testament Scripture, and that among barbarous tribes at the present day a clear and accurate perception of colour exists, sufficiently I think proves the fallacy of the doctrine that for recognition of colour education of the sense is necessary.

Mr Gladstone alludes to the prevalence of colour-blindness, and as this is a subject of much interest, and one engaging much attention at the present day, I may be permitted shortly to refer to it.

Colour-blindness (or Daltonism, as it is frequently termed, from the circumstance that Dalton, the chemist, was affected with it,

and described his condition accurately) may be the result of injury or disease of the eyes, but is in the vast majority of cases a congenital defect in which, while the eyes may be capable of most accurately distinguishing the form and light and shade of an object, they are incapable of recognising the existence of certain colours.

The most common variety is that in which there is an inability to perceive red, and this is called red-blindness; the next most common is that in which green can not be perceived—this is termed green-blindness; while a rare variety is that in which violet cannot be distinguished.

There are only four or five cases on record in which persons were incapable of distinguishing any colour, and none of them have been very thoroughly investigated, and their condition fully described. The one of which we have the best account it described in Dr Wilson's book on colour-blindness, who, however, has only his information second-hand. The person affected with this peculiarity of vision was, strange to say, a house-painter, and declared he could not distinguish any colours but black and white. The explanation of his prosecuting a calling for which apparently he was so unfitted, is found in the fact that he was an excellent draughtsman, with a good eye for form, and skilful in designing. He trusted to his wife to keep him right in selecting and mixing colours; but on one occasion when she was out of the way, and workmen were scarce, he personally took a part in painting a public building in England, which he had been employed to put in order. He mixed the colours himself, and believed that he had produced a *stone* tint, with which he proceeded to cover the walls; but after he had gone over some square yards, he was informed that he was painting the building *blue*.

Persons who are colour-blind may remain in ignorance of their defect for many years, until some startling circumstance occurs which reveals their condition to themselves and others. Numerous examples of this are on record, of which I may relate a few.

Thus a friend of my own affected with colour-blindness informed me that on one occasion, when visiting a friend in the

country who was proud of his well-cultivated garden, he was shown a bed of geraniums in front of the house, to which his friend pointed with an air of satisfaction, exclaiming, "Isn't that a magnificent display!" "Yes," responded the visitor, "they do seem a remarkably healthy set of plants." This appearing to the self-satisfied proprietor a somewhat inadequate response, he said, "But is not the blossom splendid?" "Blossom!" said my friend; "I see none;" and it was only on approaching close to the flowers that he distinguished by the form that the bed of geraniums was one mass of scarlet bloom.

An artist is recorded to have had a pupil apprentice, whom he released from his engagement in consequence of finding him copy a brown horse in bluish-green, paint the sky rose-colour, and roses blue.

A carver and gilder, who was a good draughtsman, painted a head with the face muddy-green, and mistook a packet of emerald green for vermilion.

Several members of one family, belonging to the Society of Friends, were markedly colour-blind. One of them provided himself with a bottle-green coat, intending to purchase a brown one; and selected for his wife, who desired a dark gown, a scarlet merino. Another, who was an upholsterer, purchased scarlet for drab, and had to rely upon his wife and daughters to select for him the fabrics needed in the course of his trade. A third, who was a farmer, could not tell red apples from the surrounding green leaves, except by their shape.

The case of a minister, in the Society of Friends too, is recorded, who selected scarlet cloth as the material for a new coat.

A doctor affected with colour-blindness states that in purchases he made many mistakes. He bought a red dress, thinking it a green one. He has bought red and green trousers, thinking they were brown, and had to get them dyed afterwards to enable him to wear them. In Paris he bought a red cap to wear instead of a hat, thinking it a green one.

A tailor's foreman only became aware of his defect on promotion when he had to match colours for the journeymen. He

was soon involved in grievous difficulties. The *scarlet* back of a livery waistcoat was provided with *green* strings *to match*. A ruddy brown was put side by side with a dark green, while a purchaser was informed that a red and blue stripe on a piece of trouser-cloth was all blue.

An amusing account is given of the presentation of Dalton at court. "Firstly, he was a Quaker and would not wear the sword, an indispensable appendage of ordinary court-dress. Secondly, the robe of a doctor of civil laws was known to be objectionable to him on account of its colour, scarlet—one forbidden to Quakers. Luckily it was recollected that Dalton was afflicted with colour-blindness, and that as the cherries and the leaves of a cherry tree were to him of the same colour, the scarlet gown would present to him no extraordinary appearance. So perfect, indeed was the colour-blindness, that this most modest and simple of men, after having received the Doctor's gown at Oxford, actually wore it for several days in happy unconsciousness of the effect he produced on the street."

Dr Wilson states that he knew of cases among haberdashers and silk mercers, and on enquiring at one of the latter, who had served under a colour blind master, and thereby had his attention directed to the matter, what became of those haberdashers who could not distinguish colours, obtained the unexpected reply "that they generally ended in mourning warehouses."

Numerous investigations have been made into the prevalence of this defect by observers in different parts of the world, and their results on the whole closely correspond. An examination of above 50,000 males showed that about 4 per cent. or one in twenty-five of the whole male population are colour-blind, while, marvellous to relate, colour-blindness is much more rare in females, only about one in 500 or 600 being thus afflicted. The large extent to which this defect exists among males, and the circumstance that the colours which are not recognised correspond to those employed in signalling, shows the necessity that exists for a careful examination as to their colour sense of engine-drivers, stokers,

signalmen, in fact all men who are employed upon railways; as also of pilots and officers, and crews of steamers and sailing vessels at sea. One can readily understand how a mistake in recognising the colour of the signal lamp may, on a railway, lead to a most disastrous collision, with great loss of life and injury. At sea a green light is displayed on the starboard side, and a red light on the port side, to indicate the position and direction of a vessel in motion, but if the seaman on the look-out or the man at the helm is colour-blind and fails to distinguish the one light from the other, that which is intended as a guide is of no value to him, and the ship may thus be placed in imminent danger. Scientific men having had their attention directed to this subject, carefully tested whether moving signals or signals of varied form might not replace signals of varied colour, or whether multiple white signals might not be employed. But they arrived at the conclusion that the coloured signals were on the whole the most convenient and satisfactory for use. There can be no question, however, that in the interest of public safety, all seamen and all men employed on railways should, prior to engagement, undergo a careful examination as to their perception of colours. This is done only in a rough way by railway companies in this country, but much more efficiently in Norway, Sweden, Holland, and many parts of the Continent; while no examination, as far as I am aware, is made regarding this perception of colour in the Royal or Merchant Navy.

A great many methods of testing a person's power of perceiving colours have been recommended, but the simplest and most efficient is to place a number of small skeins of Berlin wool of different colours on a table-cloth or other light ground, and taking one, say of a light green colour, ask the person to be examined to place beside it all the other skeins of a similar colour. Should he do this readily without a mistake, he may next be tested in a similar manner with a purple skein, and if he stands this test he may be considered to have a correct perception of colour. The mistakes made by the colour-blind are often most

startling—yellow, grey, and green skeins being assorted together, or bright blue and deep gray and purple.

There are many points upon which I would like to speak, such as the great increase in delicacy of the other senses (especially hearing and touch) in those bereft of sight, the method of instruction of the blind, and the wonderful light that has been thrown upon the nature of diseased conditions in the interior of the eye by the invention of the ophthalmoscope, a small and simple instrument, whereby a beam of light can be thrown through the pupil into the interior of the eye, and the whole of the depths of that organ examined as clearly as its outer surface. But time fails me, and I will conclude by impressing upon you the duty of cultivating the valuable gift you possess in sight, and give some hints as to its preservation.

It is worthy of remark the extent to which vision may be improved by cultivation. And this is due, not only to an increased accuracy of observation, but to a greater acuteness acquired by the organ itself. The Indian who tracks among the winding paths of the American forests the particular footstep of his friend or foe, does so not merely by his accurate power of observation, but also by the delicate sensibility which practice has developed. The botanist who in his walks sees every plant that blooms beside his path, enjoys the reward of the cultivation his eye has received. The sailor who traces in extremest distance the faint white line of breakers that marks the hidden reef—a line invisible to the inexperienced who stand beside him—affords another illustration of what constant practice may do for the improvement of vision.

It is a duty which we owe to our Creator who has endowed us with this wondrous faculty, to cultivate it by every means within our power; and the performance of this duty is its own reward, for the more the eye is cultivated, the more varied and minute are the pictures it gives our minds of the scenes among which we live, and the greater is the pleasure we draw from the boundless field of nature.

But it is no less our duty to do all we can to preserve our

sight. Disease often comes on so insidiously, and becomes so serious before attention is directed to it, that art may fail to cure what a little care might have prevented. It is impossible for me here to lay down a code of laws which should regulate you in the employment of your eyes. All I can do is to point out a few circumstances which tend to throw an additional strain upon, or serve to irritate them, so that this may be avoided.

To work in a subdued light is by many supposed to be advantageous to the eyes. This, however, is erroneous; when the light has become so obscure that the occupation can only be pursued with difficulty, then the strain upon the eyes is quite as injurious as would be a dazzling glare of light. Here, as in many other things, extremes are to be avoided, and the bright diffuse light of day (out of the direct sunshine) is the best light for most occupations. Where, however, artificial light must be used, a steady light sufficient brightly to illuminate the work we have to do, without dazzling and without overheating the room, should be chosen. The light should be placed above and a little to one side. Almost all artificial light, whether proceeding from lamps, candles, or gas, differs from daylight in possessing a larger proportion of red and yellow rays, which is a source of irritation to many sensitive eyes. This may be obviated by slightly blue-tinted globes to the lamp or gas, or by wearing blue-tinted spectacles, whereby the light is softened and made more like daylight.

The attitude while at work is of great importance. The head should be as far as possible kept erect, and the work if necessary elevated on a suitable stand or desk, so that the necessity for stooping may be avoided. The stooping posture causes an increased flow of blood to the head and eyes, inducing a feeling of discomfort often to such a degree as to demand a desistance from work. Where there is any shortsightedness too, prolonged stooping is productive of an aggravation of that defect, and may even lead to serious mischief in the interior of the eye; and even where the eyes are healthy and not near-sighted, prolonged work

in the stooping posture may induce such over distension of the vessels in the interior of the eye, that their coats may give way, and great temporary and even considerable permanent impairment of vision result.

At the present time, when cheap literature is in demand, the type is often most trying. Examples of this we find very common in the daily newspapers. Those whose sight is somewhat defective should eschew the paragraphs or columns in small indistinct type, and should give deserved preference to those papers that are well printed on good paper.

Reading habitually while travelling by rail is another common source of hurt to eyes that are not strong; the constant movement imparted to the paper by the vibration of the carriage causes an increased strain upon the eyes.

The persistent application of the eyes to fine needlework which is so prevalent at the present day, is also frequently productive of mischief, especially in those who are shortsighted, and who pride themselves on the fineness of the work they can accomplish.

As I had occasion to explain at a previous part of this lecture, as age advances the power of accommodation (or focussing of the eye) fails, and the necessity arises for the use of spectacles for reading or seeing objects distinctly near at hand. Many put off as long as they possibly can the employment of these aids to vision, under the idea that spectacles serve to weaken the sight. This is a great fallacy, as the strain thrown upon the eyes by attempting to work without spectacles when spectacles are necessary, may be the source not only of pain and annoyance, but of positive disease, which may be readily averted by the use of suitable glasses.

Lastly, tobacco or stimulants used in excess may be the cause of serious impairment of vision. I am far from taking the extreme step of denying persons either of these luxuries, but I only desire to mention that when indulged in *to excess*, they are injurious to the eyes. A strong healthy man engaged in arduous physical occupation may in safety, and perhaps with advantage,

at any rate with comfort, smoke his pipe, and quaff his glass of beer, while a weakly, delicate man, whose work keeps him seated at a desk most of the day, may find even what appears a moderate amount of tobacco or stimulants produce a general derangement of the nervous system with failure of the sight. In this, as in all things, true temperance, that is to say moderate enjoyment, should be the rule.

Finally, I cannot omit in a lecture such as this, some reference, however slight, to the procedure to be adopted in some of the more common diseased conditions and accidents to which the eye is liable. I need scarcely say that in all cases skilled advice should at once be sought, and my remarks will be strictly confined to what should be done in urgent cases in the time that may elapse ere professional assistance can be obtained. In all severe inflammations of the eye, simple bathing with water (either cold or tepid as the sensations of the sufferer may direct) is the safest remedy to employ, and no lotion or other application, however strongly recommended, should be had recourse to, till sanctioned by medical advice. I cannot too strongly deprecate the practice very commonly followed of applying poultices of bread and water, bread and milk, tea-leaves, porridge, or other substance to an inflamed or injured eye. There are a few diseased conditions in which poulticing is productive of benefit, but in the great majority of inflammatory affections, poultices serve simply to aggravate the disease, and convert what was a simple and by no means serious affection into a severe one, endangering the sight. Keeping wet cloths applied to the eye, and bandaging up an inflamed eye, though, like the poulticing, apparently a very simple and harmless procedure, may also be productive of much mischief, and should never be employed without the orders of the surgeon. I have seen, and continually see, too many instances in which eyes have been seriously damaged by the use of poultices, by the application of wet cloths, and even by simple bandaging of the eye, not to seize this opportunity of sounding a warning note, which, I trust, may help in diminishing the number of such cases.

In like manner, lotions or eye-drops or eye-salves that are beneficial in certain inflammations of the eye, are most injurious in their influence upon others, and should never be used indiscriminately upon the recommendation of some well-meaning but most reprehensible friend, who may have found the application recommended of service when he himself happened to be afflicted with a sore eye. It must be borne in mind that inflammations of the eye are very multifarious, and remedies must be suited to each individual case, and that it is only one who has scientifically studied those affections who can discriminate the various types of inflammation, and thus prove a safe adviser as to the treatment to be adopted.

Very recently I saw a man who had been troubled for a considerable time with a slight inflammation and redness of the margins of the eyelids, and who, noticing that a sister affected with a chronic skin eruption had been very much benefited by a certain lotion, thought his eyelids might be improved by the same. He, however, soon discovered that his reasoning was in some way defective, as very severe inflammation of the eye resulted from his application, which inflammation was with difficulty cured.

Although the eyelids serve, as a rule, as efficient protectors to the eyes, it occasionally happens that some fine particle of dust or sand escapes their vigilance, and obtains admission to the eye. The irritation produced by its presence induces a copious flow of tears, whereby the offending body may be at once washed out; but sometimes the irritating substance finds its way under the upper eyelid, and remains fixed there by the pressure of the lid, causing great annoyance whenever the eyelid is moved. Means must at once be adopted for the removal of the foreign particle. In some cases simply plunging the face into cold water and opening the eyes under the water will suffice, but generally the eyelid requires to be everted (that is to say, turned inside out), and the offending body picked off, or what often answers admirably, the upper eyelid should be drawn forwards off the

eye by means of the eyelashes, and the lower eyelid pushed up under it. When the eyelids are released the eyelashes of the lower lid will brush over the inner surface of the upper lid, and almost certainly remove any substance that may lodge there. Should such simple means fail, the eye may be tied up with a pad of cotton wool over it, so as to prevent the eyelid moving till professional advice be secured.

Frequently serious damage is occasioned by lime or other caustic substance getting into the eye. When this accident happens the eye should as quickly as possible be thoroughly washed with cold water, a stream of water being allowed to course across the opened eye, while any particle of caustic substance that remains should be carefully removed. A drop of castor oil or olive oil applied every half-hour to the inside of the eye will help greatly to allay irritation. All bandaging or poulticing in such circumstances is most injurious.

Wounds and injuries of the eye, even those apparently of a trivial nature, may, in many instances, be productive of disastrous consequences. Professional advice should be obtained without delay, as often injuries slight in extent, and produced by such a trivial weapon as the point of a needle, may, in consequence of their situation, not merely induce serious changes leading to loss of sight in the eye injured, but sympathetically cause such implication of the other eye as to produce total blindness. The knowledge of this circumstance frequently leads the surgeon to urge the sufferer to submit to the removal of the injured, to preserve the sight of the sound eye.

Until the surgeon is seen in all cases of injury the less that is done the better. A light pad of cotton wool may be applied over the closed lids and kept in position by a handkerchief, or if opportunity for the application be at hand, a pledget of cotton wool soaked in *cold* water reapplied *cold* at least every five minutes may with advantage be employed.

Time, however, fails me to enter more fully into such matters, and I must hasten to an end. Let me therefore in conclusion refer

to an expressed opinion of an old teacher of mine own, for whose memory I entertain the profoundest respect, that most amiable of men, accomplished of chemists, and charming of lecturers, George Wilson.

In an admirable little work entitled "The Five Gateways of Knowledge," he draws a comparison between the misfortune of one who has lost his sight and one who has lost his hearing. He maintains that the latter is the severer misfortune, but in this I hold he is mistaken. The instances he selects are Milton and Beethoven. Now, as music was what Beethoven's soul delighted in, and the pleasure from that was for ever dissipated by the loss of hearing, whereas Milton's happiness was not so intimately connected with sight, the instances chosen are not exactly parallel; but still let us compare the effects of the loss of these important senses in them.

There is certainly a peculiar sadness in the spectacle of the old musician playing over his glorious compositions and only fancying their wondrous harmony. Still he could look around him and observe the grand beauties of nature, and read in the eloquent countenances of his hearers the effects his music produced; while blind old Milton saw not this beautiful world which he could so intensely appreciate, and could only judge by the feebler eloquence of words, the power of his song. Listen to his own description of the dreadful blank that blindness may produce, in his description of Samson bereft of sight and in the power of his enemies, and think which is the greater evil:—

> But chief of all,
> Oh loss of sight, of thee I most complain!
> Blind among enemies, O worse than chains,
> Dungeon, or beggary, or decrepit age!
> Light, the prime work of God, to me is extinct,
> And all her various objects of delight
> Annull'd, which might in part my grief have eased,
> Inferior to the vilest now become
> Of man or worm; the vilest here excel me:
> They creep, yet see; I, dark in light, exposed

To daily fraud, contempt, abuse, and wrong,
Within doors, or without, still as a fool,
In power of others, never in my own;
Scarce half I seem to live, dead more than half.
O dark, dark, dark, amid the blaze of noon,
Irrecoverably dark, total eclipse
Without all hope of day!

MINOR AILMENTS AND THEIR TREATMENT.

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In using the term "minor ailments," I am desirous, at the outset of this lecture, that you should entertain a just conception of the phrase; and that neither, on the one hand, should you attach too little importance to the ailments therein included, nor on the other should undue weight be given to them. I wish you to bear in mind this fact, that, *occasionally*, these indications of departure from the condition of perfect health, of which the sufferings arising from the minor ailments are the evidences, prove to be the first warnings of very grave disorders; though, much more frequently, with the cessation of these symptoms and discomforts all danger has passed, and the return to the usual condition of health is established. The one important point to be deduced from this statement is, never to ignore these gentler warnings of deranged health, however slight they may be.

What are we to understand by minor ailments? These may well be defined as the first departures from a condition of perfect well-being, which I suppose all of us have, at some time or other, experienced in our own persons. And these consist, it may be, in some disordered condition of the blood, or in some alteration in the quantity or quality of the nutritive fluids, or in some disturbance in the nerves which preside over the due distribution of these, but all of which disturbances are temporary and of short

duration, and are soon rectified by nature, aided or unaided, the individual again regaining his state of comparative health.

We all, I doubt not, have met with men who, with legitimate enough pride, announce to us that they were never ill for a day in their lives, that they were never a day off work, or that they never knew what it was to have a headache. This is certainly a state of health for which such individuals can never be sufficiently thankful, and a boon for which they ought to be most grateful, though I fear it is only too true in this, as in other common every day blessings, that it is only when it begins to fail us that we begin rightly to appreciate its true value. And yet, I fancy, that even those strong and robust persons must confess to having at one time or other experienced some degree of unusual fatigue, not altogether to be accounted for by the work of the day; to having felt less vigour, less refreshed than usual on getting out of bed in the morning after the night's rest, or even to having passed a comparatively sleepless night; to an indisposition to go to work, and when at it, to feeling that it is performed with less energy, less pleasure, that it has really become a labour or a burden. Now, these are simply some of the ways in which nature indicates that some derangement of the system has occurred, it may be some very trifling alteration or deficiency in the secretions. It is a minor ailment.

Others there are again who hardly know what it is to get through a day without suffering, who pass unquiet, restless nights, who are the victims of headache, who are afflicted with such delicate stomachs and difficult digestion, that they dare not make use of the ordinary fare of which their neighbours partake, without suffering acute agony for hours. Some again there are whose nervous system appears to be so highly strung, that the petty annoyances and worries, which every man inevitably meets with in the pursuit of his ordinary avocations in life, suffice so to pervert or alter the usual physiological conditions of their system, that, from being bright, cheerful, intelligent companions, they gradually become irritable and morose, they shun society, and are disposed to retire to the seclusion of their own private sanctums,

intrusion into which they usually resent. Such men are not pleasing companions as a rule, and this they themselves are perfectly well aware of. Unfortunately this very knowledge only tends to intensify their dislike to mingle in society, and to render them less sociable. These are the victims of minor ailments.

The number of these minor ailments is so large, that the time allotted to us to-night will only permit me to glance at a few of them. I shall therefore, this evening, advert to the more general of them. And first, I shall speak of one of the most universal, viz.,

Catarrh or "Common Cold."

I suppose every one here has, at some time of his life, experienced the effects of a cold; and some of us, unfortunately, are very liable to a recurrence of this unpleasant affection, on the slightest provocation or indiscretion. You have already heard in this place, on another occasion, what dangerous results may flow from an unheeded cold. I shall therefore not delay over this part of the subject. I shall only remind you of certain conditions of the system which render those who are more than others predisposed to the frequent recurrence of catarrh, susceptible to its influence, in order that they may, if possible, avoid placing themselves in those circumstances.

Thus, it is matter of everyday experience, that a catarrh or cold is induced by any debilitating influences, however brought about, it may be by previous illness; or by over fatigue in following too closely the legitimate occupations of daily duty; or excessive study; or undue bodily exertion in pastimes, as football, cricket, lawn-tennis, dancing; all of which, excellent in themselves, when carried to the point of exhaustion, and more especially when the body at that moment, bathed in perspiration, is suddenly exposed on the return home to the sharp keen air of a frosty day, or the chilling atmosphere of a damp muggy night, almost inevitably initiate a cold.

Another fertile cause of cold attacking susceptible individuals

is, the imprudent change of dress. This is almost sure to be the penalty which the young man has to pay who discards some of his underclothing in the early spring, because there happens to be one unusually warm day in the month of March. He, feeling oppressed, becomes intolerant of the heat, casts off the protecting under-shirt, quite forgetting that the chilly month of April and the changeful May have to be passed through before we, in this northern climate, can with impunity adopt the lighter dress of summer. The old proverb is as applicable now as ever—

"Let May be in and out,
Before you e'er put off a clout."

The fact is that no one should, even in summer, dispense with the use of flannel next the skin, or some substitute such as merino. It is as important at that period of the year, as in winter.

Another cause, and this refers specially to children, is the exposure of their warm bodies, when asleep, to the cool air of the bedroom. They unconsciously throw off the bed-clothes, and if these be not speedily replaced, the result frequently is a cold. While on this subject, I may remind you that, occasionally, this throwing off of the bed-clothes by the children is more rational than it seems. Through the over-solicitude of the mother or nurse, who knows the susceptibility of the little one to take cold, the child is laden with an unnecessary supply of blankets, and very probably is at the same time enveloped in a flannel night-dress. Thus the child is oppressed with heat, and naturally endeavours to get rid of some of its burden by tossing off the clothes as often as they are replaced. Over-clothing is really as much to be deprecated as the reverse.

These, and many others which will readily suggest themselves to you, are frequent causes of catching cold. And the remedy against this very unpleasant ailment is obvious enough from what has just been said—avoid the cause.

I suppose that in so very common an ailment as "a cold," I need hardly detain you by describing its symptoms. Every one

knows from his own experience the feeling of languor and discomfort which is discovered at the outset of a catarrh, the chiliness, the feeling of cold creeping down the back, the heaviness and occasionally pain in the forehead, the difficulty of breathing through the nose, "the stuffed head," as it is called, and the accompanying nasal twang of voice. Soon there follows a thin acrid discharge from the nostrils, the eyes are heavy and watering, and towards evening a little feverishness sets in, with increased pulse. The catarrh may either stop there, or may pass to the throat, giving rise to pain, hoarseness, sore throat, and cough; or extending further into the windpipe, there is now discovered some difficulty in breathing, a sense of tightness or rawness under the breast-bone, and perhaps some wheezing. The cough is painful, dry, harsh, and frequent, being kept up by a feeling of something irritating or tickling the windpipe. Soon, however, the cough brings up some mucus, and with this expectoration there is usually experienced a sense of relief from the constriction and rawness in the chest. The discharge from the throat and nostrils gradually changes in character, becoming thicker, less acrid, and more abundant, and with this change all the other symptoms abate in severity, and in four or five days the sufferer is comparatively well again, though perhaps he may be left a little weaker than usual for a few days more.

This is the ordinary course of a common cold, when it attacks a robust, healthy man. The usual termination is in recovery. But, unfortunately, it is not only the strong individuals who are the subjects of catarrh, but it also lays hold of the delicate and weakly persons; and the termination of a catarrh in their case is by no means so rapid, nor so satisfactory. It may only prove to some of them the prelude to much more serious and lasting disease. For information on this subject, I cannot do better than refer you to that valuable and interesting lecture which Dr Affleck delivered to you last year.

Now if this be a possible termination of so minor an ailment as a common cold, it behoves every one to take some trouble to

get rid of it. Let no man ignore a simple cold if he be wise, more especially if there be any delicacy in his constitution. Neither let a man attempt to "walk it off," as the saying is. By so doing, he is only still farther exhausting his strength, which is already weakened by the inflammation of his mucous membranes, and thereby rendering recovery more tedious. If from experience gained from former attacks, the patient be aware that he has "caught cold," then occasionally it may be arrested, in the first stage, by taking, at the very outset, a hot bath on retiring to rest, with ten grains of Dover's powder at bedtime, followed by a hot drink, such as a basin of hot gruel or a tumbler of hot toddy, with a dose of castor-oil in the early morning about six o'clock. It is well to remain indoors for the day. Should, however, these means fail, or the ailment have progressed too far before the remedy is applied, and the patient complain of soreness of chest, with cough and feverishness, then he must keep bed for three days. Mustard and linseed poultices are to be applied to the chest, warm diluent drinks are to be given, such as gruel, with honey and vinegar in it, to promote gentle perspiration, and to relieve the severity of the cough. Ipecacuanha wine, in ten or fifteen drop doses in water every four hours, will be found useful in promoting the expectoration. Laxative medicine will probably be necessary, and the diet should be light.

I will only further remark on this subject, that the most effectual means of enabling one to resist those frequently recurring colds is, to keep the body in the highest state of health. And one most excellent preventive is a bath in the morning, immediately on rising from bed. If the individual be sufficiently robust to bear it, let the bath be cold; and the test by which to know whether the cold bath be beneficial or not is, the sensation of a warm glow which overspreads the surface of the body, immediately after the drying operations are concluded. Should the skin remain chilled and pale, then the water has been too cold, and the addition of warm water becomes necessary. By the robust, a shower-bath may be indulged in in the morning; and should this

prove too severe a shock to the system, and to many this is much too great for them even to risk, then it may be modified by standing in tepid water while taking the shower. Without doubt, it needs considerable resolution and courage for a man in a dark frosty morning to step directly from bed into a bath, and deliberately pull a string, which immediately results in a deluge of cold water over his head and his warm body. Of course the first shock is the worst; but when that has passed, the bath becomes actually pleasant. And I know of nothing that braces the system more effectually than this cold bathing in the morning, and that more powerfully enables the body to resist the effects of the cold raw air of this climate. The man accustomed to the use of cold bathing, if by chance he be deprived of it, feels miserable and unhappy for the day. He has missed his usual stimulant, and is consequently less vigorous and energetic. Now, while cordially recommending the use of the daily cold bath to the strong, I am desirous that I should not be understood as advising its use indiscriminately. There are many to whom it is not only not beneficial, but actually harmful. And such persons ought always to have the extreme coldness of the water removed by adding hot water, till the temperature of the bath rises to about 50° Fahrenheit. I repeat that the test by which to ascertain whether the cold bath is safe or not, and this applies equally to sea-bathing, is the perception of that agreeable warm sensation over the body on emerging from the bath, and a feeling of refreshment and invigoration, which the healthy man experiences after bathing.

Let me here, for the benefit of my younger hearers, interject a word of caution with regard to sea-bathing. Never plunge into the sea, however tempting it may be in a warm summer's day, when fatigued, or over-heated, or immediately after a full meal; otherwise, you will miss that after-glow which is the evidence of the good effect of bathing. The system is then too debilitated to establish the reaction, and the bather remains chilled, shivery, and depressed, instead of being warm, exhilarated, and refreshed.

I need not tell you, I presume, that young children and infants should not be treated to perfectly cold baths. Infants especially should always have a warm bath, ranging from 85° to 95°. But I must protest against the system, which some mothers and nurses adopt, of using much too hot water. They imagine that they can sufficiently accurately gauge the temperature of the water by the hand. This is a most egregious error. I have actually seen a bath prepared for an infant, into which the nurse was about to place it, which, on testing its temperature by the thermometer, marked 115° Fahrenheit. This is most unfair to the child; for by thus strongly attracting the blood to the skin, in fact producing a temporary congestion of the skin, a corresponding reaction ensues afterwards. So soon as the cool air comes in contact with the body, even though it be clothed, the blood is driven with unusual energy to the internal organs and mucous membranes, by the rapid contraction of the previously largely dilated capillaries of the skin, and there actually supervenes this very condition of congestion of the mucous membranes, the first stage of this catarrh of which I have been speaking. Now, in making use of colder water, there of course is at first experienced a slight shock, which, however, is merely momentary; then follows a period when the temperature of the skin remains lowered; and finally ensues the reddening of the surface, the pleasant glow of warmth, indicating the increased capillary circulation in the skin. This is not merely a temporary effect, but it continues for hours after, thereby relieving the internal organs and mucous membranes of an excess of blood, in this way indirectly stimulating them to perform their various functions more satisfactorily and more actively. Should this reaction be slow to set in, friction to the skin, at first gently, afterwards more firmly and energetically, ought to be employed during the bath. Indeed, for those persons who cannot under any circumstances make use of the bath, dry friction, applied to the skin by means of a hair-glove or flesh-brush, will be found to be a most valuable substitute.

Cough.

This, as we have already seen, is an almost invariable accompaniment of bronchial catarrh. Indeed, cough cannot be regarded as a distinct ailment, however harassing and prominent it makes itself. It can only be regarded as a *symptom* of some affection.

The act of coughing, as you are aware, is an effort made to get rid of something which is irritating the windpipe. The mechanism by which cough is produced is somewhat complicated, though the act appears simple enough. It is effected by the individual taking a full breath; the glottis, or upper portion of the windpipe, is then closed for a second; and finally, it is suddenly burst open, with considerable noise, by the expiratory effort of the air confined in the lungs, aided by the pressure of the abdominal and thoracic muscles. In this way considerable force is exerted, and in the suddenly expelled stream of air any mucus, or other offending matter, is ejected from the bronchial tubes into the mouth.

Cough, as I have said, is a symptom of disease, and is often sufficiently characteristic to indicate the nature of the affection of which it is the attendant. Thus every mother knows the peculiarly harassing, violent, long-continued spell of coughing which occurs in hooping-cough, ending in the long back-draw or whoop. And in like manner, the experienced physician is often able to tell the nature of the affection, by listening to the sound of the cough, and to refer it to its proper source.

But after the original cause which excited the cough has been got rid of, it frequently enough occurs that a sensitiveness of the mucous membrane of the throat remains, and any slight irritation, such as the inspiration of cold dry air, may give rise to a fit of coughing. Even the repeated act of coughing keeps up the irritability of the mucous membrane; and just as scratching of the skin begets scratching, so coughing begets coughing. The individual gets into the habit of coughing, and makes no effort to restrain it. How pernicious this is to the individual himself I

have already shown; but worse than this, he becomes a serious nuisance to his friends, for which there is no excuse. And this habit of coughing is peculiarly catching, as must be evident to every one. If any one doubts it, only let him note it the next time he goes to church, where occasionally the noise arising from this cause is, as distracting, as it is unnecessary. I know of nothing more annoying or more irritating to a public speaker than to have, perhaps, some of his finest perorations drowned by this useless noise. Coughing, let me insist upon it, is greatly under the control of the will, and children ought to be taught to try to restrain the inclination to cough; and very often, by this very effort, the desire to cough will vanish. And if it cannot be avoided, they should be taught *how* to cough. It is not in the least necessary to give way to coughing on every occasion, even though there be really something to expectorate, until the mucus or other irritating matter be within easy reach, and then one good, effective, deliberate cough will do as much, or probably more, for the relief of the individual, than perhaps a dozen of repeated, noisy, resultless fits of coughing.

Then as to the noise which accompanies the act, this can be greatly modified at the will of the individual. But there are some people who make not the slightest effort to lessen this annoyance, and look upon one as heartless, and wanting in feeling if he venture to suggest that a little less noise, in the unavoidable act of coughing, would be to the advantage of the other patients, say, in the ward of the hospital. In many cases the mouth may be closed, and in all the hand may be held before the mouth during the act. In this way considerable modification of the noise may be attained. When coughing is unavoidable, one cannot but sympathise with the sufferer, and endeavour to alleviate it; but where it is a mere trick or nervous habit, one can have small tolerance for it; and such persons ought not to be permitted to go into public assemblies, to make themselves a nuisance to their neighbours, until they have learned to control this nervous irritation.

From what I have said you will have gathered that cough is

not an ailment to be treated *per se*, but is one of the symptoms of other affections which will call for attention in the management of them. I would caution you, therefore, against making use of any of those nostrums which are vaunted as a cure for all sorts of coughs and colds. They mostly all contain opium in some form. They may give relief to this symptom, but they may prove prejudicial to the real complaint which initiates the cough. At the same time, it is a very distressing symptom, and urgently calls for amelioration. There never can be harm in causing the patient to inhale steam of hot water from a sponge, or basin of boiling water. Or infusion of hops may be made, and inhaled. Then lozenges of various kinds are often useful, *e.g.*, fruit, gum, glycerine, liquorice, marsh-mallow, tamarind, ipecacuanha, &c. Linseed-tea is a bland, soothing demulcent, useful in sore throat, and in allaying tickling cough. It is made by taking one ounce of linseed, one ounce of white sugar, half an ounce of liquorice-root, four tablespoonsful of lemon juice, and adding to these two pints of boiling water. Let the mixture stand for four hours in a warm place, then strain, and it is ready for use.

Sore Throat.

This is a constant accompaniment of some very serious disorders, such as scarlet fever, measles, small pox, diphtheria, &c. With these forms of the affection we have nothing to do. They lie outside the scope of this lecture. That form of sore throat in which we are specially interested to-night is, most frequently, the result of exposure to cold and damp, when the body is heated. It may be confined to the parts situated at the back of the mouth, *i.e.*, the tonsils, palate, and pharynx, or it may extend a little further into the windpipe. The affection is an inflammation of the mucous membrane of the parts enumerated.

The most prominent symptom is, soreness. This is most evident when attempts at swallowing are made. Even the effort of swallowing the saliva gives rise to pain. On inspecting the throat it is observed to be red, tumefied, swollen, and instead of being

moist it is probably dry, and possibly there may be seen some mucus adhering to the membrane. Most likely the voice will be altered in tone, or it may even be lost. Cough is pretty sure to be a symptom; and it is usually frequent and painful.

Most of these cases speedily recover without any active treatment, provided the invalid will have patience for a few days. All that he need do is to confine himself to the house, better to one apartment, and still better to bed, for a couple of days; to avoid all conversation; to apply a warm poultice to the throat; or a moist compress may be worn around the throat night and day. This is made by wringing a piece of lint, or a pocket handkerchief, out of water sufficiently so that it does not drip, and it is of small moment whether the water be cold or warm; it is now applied to the throat, and covered with a piece of macintosh, and then a woollen comforter is put over all. Ice may be sucked continuously, if agreeable to the patient. If it be not, then a gargle of warm milk and water should be employed every hour. A smart aperient dose of Epsom salts or castor oil should be taken in the morning before breakfast, *i.e.*, one tablespoonful of salts in a tumblerful of hot water. If, under this treatment, the throat do not improve in two days, it has ceased to be a minor ailment, and the physician must be sent for.

Another variety of sore throat is that which is known by the name of

Quinsy,

or inflammation of the tonsils, two glands situated at the back of the mouth. These glands, both from their position and their peculiar structure, are unusually liable to participate in all affections of the throat. This inflammation of these structures is principally observed in changeable climates; and seems to attack, by preference, young adults. Children rarely suffer from quinsy; and it is well known that persons, who have once been the subjects of this ailment, are very liable to a recurrence of the disorder. It is also asserted that persons of rheumatic constitution are

frequently the subjects of attacks of tonsillitis. The most common exciting cause of quinsy is, exposure to wet and cold, with a chilly east wind; tolerably frequent concomitants in this city.

The symptoms which usher in the approach of a quinsy are usually manifested by indications of fever. This is preceded probably by chilliness, or even by decided shivering. The patient then becomes restless, irritable, and hot. He complains of general weariness and soreness, as if he had been beaten. He has headache, and, if young, may even become delirious at night. The tongue, a good indicator of the state of the general system, more particularly of the digestive system, is covered with a thick, dense, yellowish coating; the breath is heavy, and of peculiar odour. The voice is altered, becoming indistinct, thick, guttural, and nasal. The mouth is opened with difficulty, and swallowing is attended with much pain, even of the saliva, so that it is often allowed to flow out of the mouth. Respiration is impeded, being noisy during the day, while at night the patient snores during sleep. Occasionally he may become deaf.

The first indication of uneasiness in the throat is a complaint of pricking and dryness in the region of the tonsil, soon passing on to actual soreness, and pain of a dull character, which shoots up towards the ear on the affected side. Externally, some swelling may be observed which is painful to touch. On inspecting the mouth, one tonsil, rarely both, will be observed to be considerably swollen, and of a bright red colour, with perhaps some patches of yellowish secretion adherent to its surface. The soft palate and uvula are œdematous and swollen. This state of matters may continue for four or five days, gradually increasing in severity, and then the inflammation may slowly begin to subside, and finally disappear in ten days, after which time the patient may again be able to resume his usual employment. Frequently, however, the process runs on to suppuration, in which case the symptoms become aggravated, the swelling and pain increase, swallowing becomes nearly impossible, breathing is seriously im-

peded, speaking is not attempted, and altogether the sufferer is in a deplorable condition. But precisely when matters have reached this pitiful state, the abscess bursts spontaneously and unexpectedly. Relief is immediate, with the discharge of fetid pus, and convalescence is speedily established.

Those who are liable to this form of sore throat, and who know from the premonitory symptoms what is impending, ought at once to adopt measures to try to prevent it going so far as I have described. These, though unfortunately not always successful, consist in using strong astringent gargles; in the administration of single drop doses of tincture of aconite, every hour, for half a day, and a brisk saline purgative in the morning, such as a dose of Rochelle salts. For gargle, one of the best is the old fashioned homely mixture, consisting of three tablespoonsful of red wine (port or claret), one of vinegar, half a teaspoonful of powdered alum, and a little sugar, in a tumbler of cold water. This to be used every hour. If, however, the affection has gone too far for this abortive treatment, then the patient must be confined to bed; hot poultices must be kept constantly applied to the throat; steam from hot water should be inhaled often; a gargle of hot milk and water should be used hourly; and ice, if grateful, may be constantly sucked. A sal prunelle ball may be allowed slowly to dissolve in the mouth. The diet should be given in semi-solid form, *e.g.*, arrowroot made with milk, soup thickened with rice-flour, or better still, beef-jelly, if the patient can be persuaded to swallow at all. If the abscess do not speedily rupture, and more particularly if both tonsils be simultaneously affected, then it may be necessary to call in the aid of the surgeon to lance it. The necessity for this will be evident by the continued and increasing distress of the sufferer, the great difficulty in breathing, and the extreme restlessness and feverishness of the patient. In a first attack, too great delay ought not to be allowed to take place before asking the assistance of the surgeon.

Rheumatism.

This is a disorder almost as general as a common cold, and is particularly frequent in cold damp places. In fact, so prevalent is it in some districts that the term "rheumatic" has been applied to it, either because of the great number of inhabitants so afflicted, or because a new comer to such district is pretty sure to become a victim to this painful affection. But it is not by any means confined to certain districts. Everywhere, in this cold, damp, variable climate of ours, we find numerous examples of it. Neither is it confined to persons of any special rank in life, but in every class of society, in both sexes, and at all ages, you find people complaining of this unpleasant ailment. And the worst of it is, that when once it has fairly laid hold of an individual, he is never sure when he may be free of the enemy. It has a most unpleasant faculty of returning to visit its old haunts. The fact is, that one attack, so far from giving immunity from a second, as is the case in many of the acute infectious disorders, seems to predispose to the onset of another.

There are varieties of this disorder—the acute, or rheumatic fever, the subacute, and the chronic. About the first two I have nothing to say this evening. They are major ailments, and the acute variety often leaves behind it serious effects and a damaged constitution. It always demands most careful supervision of the medical attendant.

As most people are aware who have suffered from rheumatism, the parts of the body most commonly selected for the attack are the joints, muscles, and fibrous structures, and unfortunately for the patient, these attacks which give rise to so much pain are often most troublesome at night, and interfere most materially with the night's rest. There is, however, another form of chronic rheumatism which, on the contrary, is characterised by the affected parts feeling somewhat cold, as well as stiff and painful, and which sensations are much aggravated by damp cold weather, and are relieved by warmth and the heat of the bed. This variety is spoken of as cold rheumatism.

The two grand characteristic symptoms of chronic rheumatism are, pain and stiffness. These are felt either in the joints themselves, or in the structures more immediately implicated in their movements, or in the muscles. So severe and so long continued are these affections of the joints, that ultimately they become enlarged, disorganised, and distorted. The poor sufferer becomes helpless and bed-ridden; his general constitution is entirely shattered; he becomes emaciated, anæmic, and debilitated; in fact, he is a helpless cripple. Examples of these unfortunate victims of chronic articular rheumatism may be met with in every workhouse infirmary. This condition is brought about by repeated attacks of the subacute variety, one probably succeeding the other at such short intervals, that the patient has barely recovered from the first attack, before, apparently without any assignable cause, he is laid down again with another of probably equal, it may be even greater intensity; until, finally, he is really never free from this harassing, distressing pain.

But happily rheumatism does not always proceed to such lengths; and although certain persons suffer severely enough from their articular pains, they always experience intervals, of varying length, of complete immunity from their aches and pains. In such cases the affection is usually limited, at least, for a long time, it may be years, to one joint. The pain experienced is of a dull aching character, varied with occasional severe twinges; the joint becomes swollen and tender to touch, the limb feels heavy; there is manifest disinclination to make use of it, for movement of the joint greatly aggravates the pain. This is usually worse in bed; but if the patient could only be persuaded to permit movement of the joint to be made for him, he would soon discover that, after the first immediate aggravation of the pain had subsided, he was able to move the limb with comparative ease and freedom from pain. The stiffness and pain are materially relieved by this passive movement of the limb. Very often, when the joints are not the seat of pain, it will be observed that they have a tendency to creak when particular movements of them are made, and they feel stiff and dry.

There is another variety of rheumatism which seems to locate itself in the muscles and fibrous tissues, usually spoken of as muscular rheumatism, where the joints are comparatively unaffected. This is the variety which commonly affects children, not that they are by any means exempt from the acute form, and which exhibits itself as "growing pains," stiff neck, wry neck, lumbago, chest pain, or pleurodynica, &c. Of course such persons seem to have either inherited or acquired the rheumatic constitution, that is to say, that they exhibit a peculiar predisposition to be affected with these muscular pains, when subjected to any of the known causes which give rise to rheumatism, but which same causes do not, in like manner, produce such pains in those who are not so predisposed. Thus, suppose two persons to have been exposed, perhaps at the same moment and in equal degree, to a thorough wetting, to a draught of cold air playing upon the body, to a chill, after being heated, and it may be when the body is perspiring, or to have incautiously thrown themselves at full length on the damp grass, when fatigued. The one individual may rise from the ground refreshed and ready for several more hours' hard work, while the other gets up, feeling less weary, perhaps, but stiff and sore all over, with considerable pain in his back probably, which occasionally amounts to spasm, and is increased when he attempts to straighten himself. This last man is now affected with the minor ailment termed lumbago. He being predisposed to be attacked by rheumatism, inheriting the rheumatic constitution, is seized upon by the enemy when he is off his guard, and forgets about his proclivity. Such persons ought on no account ever to stretch themselves on the damp ground, or even to sit upon what appears to be perfectly dry grass, if they desire to avoid an attack of this nature. They cannot afford to take such liberties with themselves in our humid climate, with impunity.

The symptoms indicative of this muscular form of rheumatism are usually manifested by pain in the muscle specially affected; at least, this is the prominent one, and the symptom which bulks most largely in the patient's estimation. But without doubt, for

a day or two previous to the attack, the individual has been "out of sorts" as the phrase runs, has perhaps been a little feverish at night, less disposed for food, and may even have complained of a little soreness of throat. There is a general feeling of lassitude, and finally the pain centres itself in some definite locality; it may be the neck, the chest, or the loins, &c. This pain is at times of great intensity, and greatly interferes with the freedom of movement. Should it locate itself in the muscles of the chest, then the pain is at times excruciating, and embarrasses the respiratory movements, so that the individual fears to take a deep breath, in consequence of the acute lancinating pain to which such procedure gives rise. To cough is agony to such patients, and hence it is a restrained, short, catching cough. Frequently, the patient discovers that, by lying upon the affected side he is in a condition of comparative ease and freedom from pain; the fact being that he, thereby, materially lessens the movements of the chest wall, and thus, of course, relieves himself. And hence one of the easiest and satisfactory means of treatment in this form of rheumatism, viz., to apply a flannel bandage, pretty tightly, round the chest, in order to restrain the movements of the chest wall. Soothing liniments may also be applied to the side, such as belladonna and chloroform liniments, mixed in equal proportions. Or more stimulating ones may be called for, as the liniment of turpentine, or oil of cajeput mixed with olive oil.

When the rheumatism locates itself in the muscles and fibrous structures of the loins, it is spoken of as *Lumbago.* The pain in the back is the leading feature in this affection, the intensity of which varies in each case. Some persons are able to go about their daily avocations though suffering considerable pain, and compelled to assume awkward attitudes to avoid putting the affected muscles on the stretch; while others, again, cannot raise themselves from the horizontal posture, without inducing most acute pain in those muscles which are called into action when one elevates himself to the erect posture. To raise one self, after stooping, produces a spasm of the muscles and tendonous structures, so intense, as to elicit from the sufferer a strong expression

of his agony; and to avoid the pain, which, from experience, he knows is produced by sudden movements, or even by the attempt to turn himself in bed, he makes use of the strangest devices, and assumes the funniest contortions; so that the bystander, even at the risk of being branded as the most unfeeling of friends, cannot resist the provocation to laughter thereat, much to the chagrin of the invalid, who finds it truly no laughing matter. Happily this, though a sufficiently trying affection, is not a dangerous one. The remedies which have been proposed for the relief of this rheumatic affection are numerous enough. Some of the homely ones are by no means to be despised, such as ironing the back with a hot smoothing iron, of course with the interposition of a double layer of flannel between the skin and the iron. I have found that the efficacy of this treatment is heightened by wrapping the flannel round the hot iron, and moistening the flannel with vinegar. The iron, thus guarded, is to be left in contact with the skin for a quarter of a minute, at various points. Another good remedy is the application of turpentine stupes to the back. This is effected by taking a doubled piece of flannel, say 12 or 14 inches long by 8 or 10 inches wide, and dipping it into boiling water. It is then wrung firmly, and turpentine is sprinkled liberally over it. This is applied to the loins, and kept on for twenty or thirty minutes. When removed, cotton-wool is to be applied to the skin. At the outset, a strong effective purge ought to be taken. Should these simpler measures fail, then it will be expedient to apply for skilled advice. The wearing of a band of silk round the waist has been recommended as a prophylactic, and enjoys considerable reputation as a protective of some value. I have myself been convinced that this is really effective, in some cases, as a protective measure. And the only way in which I can imagine it to be of use is, that the silk, being a non-conductor of electricity, prevents the body-electricity from being too quickly discharged. This, however, is a mere theory, and I do not put it forward as the scientific explanation.

Others, again, who believe themselves to be rheumatic, never

suffer from any of these severer forms of rheumatism which I have just described; yet they are constantly complaining of various ill-defined flying pains, which flit from place to place with remarkable capriciousness, never very long persistent, but which make them very unhappy and very miserable. These are justly enough termed rheumatic pains. And it is noticeable that these pains are usually much aggravated by certain changes of weather; especially during the course of an arid east wind, in thick foggy weather, or when a "haar" prevails. Then, these unfortunate people come home feeling weary, irritable, and stiff, complaining of decided aching in the back, the loins, arms, or legs; often indeed they are hardly able to localise the spot where the pain is worst, it is so general. They are generally miserable, feel pinched, weary, and ill all over. The best thing for such a person to do is, to get as speedily as possible into bed, between blankets, after taking some very hot drink, soup, tea, water even, as hot as can be borne, in order to induce free perspiration.

So soon as this is established, the individual passes from a state of intense discomfort to one of comparative ease and well-being. This condition of comfort would be more quickly brought about were the patient to take a hot bath, of a temperature of 104° Fahr, and remain in it till perspiration be induced; then, having quickly dried the skin, he should get into bed, between blankets, to encourage this moist condition of skin.

Those persons who are subject to these short attacks of rheumatism, will often discover that they are associated, if not actually dependent upon, some derangement of digestion: such as acidity, flatulence, and distension after eating (more especially after partaking of certain kinds of food), heart-burn, eructations of gas, &c. Occasionally, it will be observed that, an attack is induced by a single glass of beer or champagne. It is very evident that these wandering rheumatic pains are, in such cases, actually initiated by the food received into the stomach, because the effect is so immediate; that is to say, those pains are developed within an hour or two after partaking of the offending aliment It is quite likely that the blood was already

in such a condition, that it required very little more addition of the deleterious material to develop the pains—the blood was, probably, already so overcharged with the effete products of disintegration of the tissues—that a very small increase proved sufficient to determine the rheumatic pains.

Now, the most important matter for those who suffer from rheumatism is, to learn how they may best prevent the accumulation in the blood of those matters, which tend to develope this painful condition. To effect this end, it is of the utmost consequence to see to it, that the three great channels by which effete matters are carried out of the system are kept in good working order—I mean the skin, the bowels, and the kidneys. If this be not attended to, an accumulation of waste products takes place in the blood. These undergo certain chemical changes, and among other products lactic acid is probably formed in excess, which gives rise to much of the discomfort known as rheumatism.

I have already indicated to you certain of the methods by which the action of the skin may be encouraged, viz., by the use of the hot bath. By its use, free perspiration may be induced. The Turkish bath and the hot air bath are other means. This latter is very easily extemporised by placing a lighted spirit lamp under a cane-seated chair; on this the patient sits, already unclothed, and he is then enveloped by blankets and other coverings from the neck. This hot air bath speedily induces a large amount of perspiration, even more than the hot vapour bath; as, in this latter case, the free transpiration from the skin is somewhat impeded, by the deposit upon it of the watery vapour. If, however, it be thought desirable for any reason to employ the vapour bath, this may be as readily and simply arranged in the bedroom, as the apparatus for the hot air bath. In this case, instead of the spirit lamp being introduced below the cane-seated chair, a foot pail is made use of, in which is boiling water to the depth of four or five inches, and into this is placed a brick, previously heated to redness in the fire. By this means, a rapid development of hot steam is effected, the skin and blood heat are raised very greatly, more so than by the hot air bath, the

result being a profuse flow of perspiration, which relieves the blood of various salts and other effete matters, which it is desirable to be rid of.

In using the hot bath—and the temperature of this should be about 104° Fahr.—it may be advantageous to make it an alkaline bath. This is readily accomplished by adding about six ounces of carbonate of soda (washing soda) to the bath before entering it. And this will be found to be specially efficacious if there be much stiffness of the joints or muscles.

In addition to the use of baths, there are many drugs which have the effect of inducing free perspiration, *e.g.*, the solution of acetate of ammonia; opium alone, and in combination with ipecacuanha; antimony; and most speedy of all, jaborandi, or its active principle pilocarpine. But these should only be employed under the guidance and direction of the medical attendant, with the exception of the first named, the solution of the acetate of ammonia, which may safely enough be made use of as a household remedy in tablespoonful doses freely diluted in water. This is the dose for an adult.

The bowels may be acted upon by any mild aperient, and preferably by the salines, *e.g.*, Epsom salts; in half-ounce dose Rochelle salt; effervescing citrate of magnesia; any of the mineral waters, as Hunyadi, Carlsbad, Friederichshall, or Æsculap waters. Two important points to be observed, when using saline aperients, are; that they should be taken largely diluted in hot water, and early in the morning, before any food has been partaken of.

The third channel by which waste products are eliminated from the body is, the kidneys. Their action ought to be kept up, and if somewhat sluggish, it ought to be stimulated, by the proper class of remedies, namely diuretics. The simplest of all is water. A tumbler of hot water drunk slowly in the morning, while dressing is going on, will be found to be the least harmful, the least unpleasant, and a very efficient renal stimulant. Should this not prove active enough, it may be rendered more energetic by the addition of a teaspoonful of cream of tartar. A favourite household drink, and a very good one, is imperial pop. It is

made by throwing a tablespoonful of cream of tartar into a pint of hot water, adding the juice of a lemon and sugar to taste. It is then strained, and used when cold. Sweet spirits of nitre, in teaspoonful dose, in a glass of water, is another good renal stimulant, and may be used occasionally. Milk, barley water, and such like gentle diluents can never do harm, and may be used in any quantity.

Alkalies are almost always useful in relieving rheumatic pains. Bicarbonate of potash, or soda, may be freely enough made use of, provided that they are not taken continuously, for an indefinite period of time. Either of them may be taken in dose of half a teaspoonful, in half a tumbler of ærated water, twice daily, for about three weeks or a month at a time. Another good method of making use of the alkali is, to add to the soda or potash the juice of one lemon, and pour over this a tumblerful of ærated water, to which, if thought desirable, a pinch of sugar may be added. This mixture may be taken twice daily, for about ten days at a time. This will be found to be a most agreeable and refreshing drink, especially in hot summer weather.

The diet of those who are of the rheumatic habit of body ought to be restricted, as regards certain articles. Thus, butcher's meat ought to be rarely partaken of. The lighter forms of solid food are more appropriate to such persons, *e.g.*, fish, soups, chicken, milk-puddings, vegetables, fruit, milk. Beer and wine ought, as a rule, to be avoided. Ærated waters may be partaken of freely. Much smoking, particularly of heavy tobacco, is prejudicial.

As already mentioned, persons who suffer from rheumatic pains ought always to wear flannel next the skin. It protects the body from being suddenly chilled, after it has become moistened with perspiration. And let me give this last caution, let no rheumatic individual complain of this tendency to perspiration; and above all, let him beware how he attempts to stop this action. It is nature's method of relieving him of still more unpleasant evils, and so far from using means to put an end to it, the patient ought to bear with it, and rather encourage it. The sweating will gradually diminish in time, and the individual will probably then

find that he is better in health, and freer from his rheumatism than he has been for a long time previously.

But now, I have tried your patience sufficiently long. As you see, I have only been able very imperfectly to glance at one or two of the minor ailments, and to give some hints as to their treatment. To give a slight sketch even of the more important of these would occupy many lectures, and that I fear would prove a little trying to your good nature. I trust, however, that what has been said to-night may be of some use to you.

NURSING THE SICK.

By J. HALLIDAY CROOM, M.D., F.R.C.P.,
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Ladies and Gentlemen,—I am to suppose that you have got some one very ill, and that you are desirous to get him well again as soon as possible. You must not imagine that you have done all you can when you have brought a doctor to him and got a bottle of physic. Both of these are important, perhaps both are absolutely essential, and yet there is a great deal more you can do to help in bringing back health and strength to your patient. It may be that recovery is hindered by want of fresh air, light, warmth, cleanliness, quietness, rest, and proper food. All those things you have in your power to bestow, and all those go to further his recovery, and constitute proper nursing just as much as making a poultice or a bed. The three great factors of life are—air, heat, and nourishment, each and all are essential to life, and deprived of them, ill-health, tardy recovery, and death are the result.

Now I wish to point out to you that these three factors are almost entirely in the hands of the nurse who is constantly with the sick person. It will be apparent to you how much she can do, either to hasten the sick person's recovery or his death, by the right use she makes of these powerful remedies.

Now let me suppose that you have the charge of a sick person. Let me say a few words with regard to the choice of a room. If you have two or three to select from, choose a sunny, light one, looking to the south. See that it has a fire-place, and that its

window opens both at top and bottom. Be sure that you get plenty of sun and fresh air. If the window has curtains remove them. It may be, however, that you have only one room, and that the window will not open. Knock out a pane of glass and across the opening so made stretch a piece of thin muslin, or better still, of perforated zinc. Your next endeavour ought to be to make the room as clean as soap and water can make it. You must brush the walls down and scrub the floor thoroughly clean. To conduce to the freshness and convenience of the room, it will be necessary to remove all the furniture excepting only that which you absolutely require. The fewer things you have in a sick room the better. Even in midsummer a small fire is useful—it helps to ventilate the room, and keep the air fresh. If you do not have a fire, then be sure to leave the chimney of the room open. Do not close the damper, nor stuff the chimney with straw.

If your patient suffer from his head or his eyes, do not let him lie in a blaze of sun-shine or gas-light; but tack a piece of dark stuff across the window, dark blue or green being always better than white.

Air of Room.—The air of the sick room should be kept as nearly as possible at a uniform temperature, always about the same warmth. Nothing can be worse than to have it sometimes very hot, and at other times very cold. Try to avoid having at one moment a large fire and the patient almost suffocated, and at another time the doors and windows open, and the patient shivering with cold. To maintain an equable temperature is, I am well aware, by no means an easy matter, especially in a small room; but care and attention will do a great deal to render this attainable. In respect of this point there is one thing to which I should like to draw your attention, namely, that the early morning hours, between two and seven A.M., are the coldest, and the period at which the vital powers are at their lowest, and, therefore, the time at which serious changes, and frequently death take place. During these hours the patient must be carefully watched, and the heat maintained by extra clothing, hot bottles, and warm drinks, and you must be careful not to allow the fire to burn low. The

neglect of these simple preeautions during the early morning hours, "the period of lowest vital intensity," has saerifieed many lives. With regard to air and ventilation, Miss Nightingale has made the following remarks :—That "the great object of ventilation is to keep the air whieh the patient breathes as pure as the external, without chilling him." It is no unusual thing to find persons in preparing a room for a siek person, careful to stop up every ereviee through whieh air ean enter, put bags of straw in the ehimney, and shut the windows tight with no intention of opening them again until the patient is well. They labour under the impression that if a breath of fresh air were to get in it would kill him, and they expect, notwithstanding the exclusion of air, that the unfortunate sufferer will get well. Let me positively assure you that he is just being as certainly poisoned as if he were being administered a dose of arsenic daily. An exeellent rule is *always* to keep the window open two inehes at the top, and besides this, twiee a day you should earefully eover your patient well up and open the window wide for five or ten minutes. There is no risk of chilling the patient if this be earefully done: with plenty of eovering and hot bottles you ean always keep a patient warm in bed. And pray do not suppose that you must shut the window at night. Night air is better and purer than day air, and people require fresh air just as mueh when they are asleep as when awake. Let me then ask you to make it a rule always to keep the window open a little from the top. One thing more, never try to air the room by opening a door on the stair or passage. By doing so you get worse air introdueed into the room. To keep the air of the room always pure, you must have a fresh supply constantly eoming in to take the place of that which your patient has used. Let me assure you that you cannot have too mueh of fresh air; it is eertainly one of the best medieines as well as by far the cheapest, and like all other things so obtained is not suffieiently valued beeause of its eheapness. At the same time you must guard against draughts, and if the room is small, and the bed, as is often the ease, between the door and the window, you ean very easily make a screen to

keep off the draught by putting a sheet or coverlet over a clothes screen.

Cleanliness of the room. In respect of this you must observe great care. Keep everything in the sick-room scrupulously clean. You should wash, sweep and dust out the apartment daily, and remove at once if possible all soiled and dirty things from it. In performing these little duties, there is no need that you should make any noise or fuss. You can do them all without in any way disturbing your patient. Choose a proper time for their performance, not for instance just when he has dropped asleep after a restless night. So much then for the patient's room. Before, however, we quite leave the subject, let me summarise :— A sunny light room with an opening window, and a fire-place— scrubbed clean—not too much furniture and clothes about—a bed and a window with no curtains—a small fire always burning, windows always down two inches from the top, (not the bottom)— the room never to be aired by opening the door into the passage— the room to be swept and dusted daily—everything soiled to be removed at once out of the room.

Let me now offer a few suggestions with regard to the *personnel* of the nurse herself. A pleasant personal appearance will go far towards inspiring confidence, and can be secured by a little neatness in dress. Trailing skirts, loose hair, and all jewellery are out of place in a sick-room. One of the secrets of enduring the strain of long continued nursing consists in the use of a daily bath. This will be found extremely refreshing and can be accomplished with a basin and towel in the following manner. Wring out a rough cloth in soap and water, and rub yourself briskly from head to foot ; five minutes each day will suffice to keep you healthy and fresh. You should endeavour to anticipate your patient's wants ; never question in regard to them ; and you will promote your patient's peace of mind very much by moving about quietly, avoiding all hurry, never asking your patient for a decision, and avoiding letting him be startled. Now there are various little things which are apt to disturb a patient. For example, whispering in the room, for it is impossible but that the

patient's attention should be strained to hear. Walking on tip-toe, and stealthily moving about the room are to be avoided. A low distinct tone and a light step will seldom annoy. If your patient is delirious, never contradict him, and humour his notions quietly.

Beyond what I have just said, no advice can be more important to you than the avoidance of all forms of alcoholic stimulants while you are engaged in nursing. There can be no question that long physical fatigue and anxious watching are better maintained on tea, coffee or cocoa than by the use of any form of alcohol or malt liquor whatever.

I am not here to advocate the claims of total abstinence generally, but I do most unhesitatingly affirm that she who would nurse the sick aright with a due regard to the patient's wants and her own comfort, and in order to perform her duty thoroughly, must, for the time being at least, become a total abstainer from alcoholic drinks.

Let me now draw your attention to the patient's bed. Some unfortunates from the beginning of their illness to the time when they are able to get up again, never have their bed made. There can be no greater mistake; the bed should be made at least once a day. If you have, for instance, a patient crippled with rheumatism or perfectly helpless from paralysis, it becomes a very difficult thing to make a bed and change the sheets, and yet if you allow him to go on lying in bed, day after day, and week after week, without changing and making the bed, you not only keep back his recovery and cause him much unnecessary suffering, but you run a great risk of giving him bedsores. As a rule, however ill the sick person may be, his bed should be made at least once a day, unless the doctor absolutely forbids it, as in some special cases he may do.

Remember this is a tiring operation to weak persons, therefore you must choose a time of day when your patient is freshest and strongest. The morning therefore is the best time, when he has had his sleep out, been washed, and had a cup of tea. You should give him a little nourishment before commencing. If possible, do

not have a feather bed, a hair or straw bed is far more comfortable for the patient. A most clean and comfortable bed is a canvas cover or bag, the size of the bedstead, not too full of fresh straw loosely put in; one side left open and tied together with strings. When you make the bed, untie the strings, get a neighbour to raise up the patient, by putting both arms under him and gently raising him off the mattress. Then plunge both your arms into the straw, and shake it up. Then tie it up again. When the bed gets soiled, the straw can be changed. This makes a clean, comfortable, and cheap bed.

I will now tell you how to make a bed. When you cannot take the patient out of it, get a neighbour to help you; do not attempt, if it can be avoided, to do it alone. You want to save the patient's strength, not to exhaust it by letting him try to help you. Now take off all the heavy top clothes, always excepting the top sheet, and remove the pillow, then while one nurse gently turns the patient on his side, the other rolls up the soiled foot-sheet against the patient's back. Now before putting on the clean sheet, untie the strings of the mattress, put in your arms and thoroughly shake up and pull about the straw, tie it up again, roll up the clean sheet, and place the clean roll against the soiled one; now turn the patient gently on to the clean side of the bed, then draw away the soiled sheet, and before spreading the clean one, untie the mattress tapes, and repeat the operation of shaking the straw on this side. Now retie the tapes, spread out the clean sheet and replace the pillow. Now take another sheet, and fold it so above a sheet of macintosh, roll it up, and while one nurse gently raises the patient the other passes this sheet and macintosh below him. This sheet may be easily and quickly changed when necessary without exhaustion to the patient. How to change the top sheet, spread your clean sheet *over* the soiled one, and with the right hand draw down the soiled one while holding the clean one in position with the left. Now replace the blankets and coverlid, and the bed is finished. If the patient is very weak give him a little beef-tea just before or during the process of bedmaking.

Any part that is subject to long pressure is apt to inflame, suppurate, and if not carefully attended to, form a sore—what is commonly known as a bedsore. The parts which are specially liable to bedsores are the prominent bone at the base of the back; also the hips, heels, elbows, and shoulder-blades—indeed, any part where the bone is prominent and thinly covered.

Old weakly people and those who are paralysed require the utmost care to prevent bedsores. If you attend carefully to the following rules, it is very unlikely that these will occur:—

1. Keep the sheet below the patient perfectly smooth—no creases or folds, and no crumbs—and let them be perfectly clean and dry.

2. Wash the parts daily with soap and warm water, dry them well, rub them over with a little spirits of wine or whisky to harden the skin.

3. Change the patient's position frequently.

4. Never let him lie on a blanket.

The first symptom of bedsore is noticed by the skin getting red and the patient complaining of a pricking feeling as if he were lying on crumbs. If the skin breaks, then paint the part over with a mixture of castor oil and collodion (do not use collodion alone). But remember prevention is best. Attend to keeping the undersheets smooth and dry, and if possible get a water pillow.

I show you two kinds, square and circular, they must be filled with warm water, and not be filled too full. Over the water pillow and under the sheet lay a folded blanket.

Do not be satisfied with only washing your patient's face and hands every day, but sponge him all over with warm water soap and a little vinegar. This will be found very refreshing, and can be easily done without the least risk of giving cold. There is no occasion for uncovering the patient. Put a blanket over him, and sponge underneath. A freshly made bed, a thorough sponge over with vinegar and water, will often, after a restless, sleepless night, have the good effect of making the patient fall into a sound sleep. In giving patients suffering from paralysis or

dropsy a hot bottle, be very careful to wrap it in flannel, and see that it is not too hot, as in dropsy the skin is very apt to blister, and in paralysis people have often no feeling in the paralysed parts, and so cannot tell when the bottle is too hot. I have seen severe and dangerous burns caused from ignorance of this. In such cases it is better to warm the feet and legs by wrapping them in a warm blanket, than by applying heat directly to the part. Among the many applications which, by the direction of the doctor, you will often be called on to apply to the sick person, are POULTICES; and once for all, let me say to you, that unless you do make these applications properly, you had much better not make them at all. One seldom sees a poultice properly applied except by a trained nurse. Either they are too large or too small, or they are improperly made, and applied often to the wrong place. For example, a cold, wet, dripping poultice, a pound or two in weight, laid on the chest of a poor unfortunate weak creature, panting and gasping for breath, is much more likely to do harm than good; and on the other hand, such a remedy made and applied properly is sure to give instant, and possibly lasting, relief. A good poultice is a very common and a most useful remedy, and every one of you should learn to make it in the very best possible way.

To make a linseed poultice, you require linseed meal, boiling water, and a piece of thick brown paper or calico, a piece of mackintosh, or cotton wool, a flannel bandage, a bowl and spatula, such as I now show you, or a knife. If you are only to poultice the chest, cut your paper or calico like this . . . . . if a jacket poultice for inflammation of the lungs, then cut it in this way . . . . .

Now, to make the poultice, First be sure the water is quite boiling, then scald the basin to make it perfectly hot; now pour in a sufficient quantity of water to make the poultice, then put in the linseed meal, stirring during the process with a spatula or knife until it is of a proper thickness. Now, turn it out on the cloth, and spread quickly, dipping the spatula now and then in hot water while doing so, to prevent the poultice sticking to the knife. Turn over the edges of the calico on the poultice, and apply

it. Then put the mackintosh or cotton wool on the top, to keep it hot, and fasten it on with the flannel bandage. If you have no linseed meal, you can use either oatmeal or bran; if oatmeal, then boil it with the water like porridge. "A poultice should be larger than appears absolutely necessary. It is intended to allay pain and inflammation, and as the pain probably extends beyond the inflamed part, a large poultice should be made to cover the inflamed part."

The poultice should be applied as warm as can be borne, and it should never be allowed to slip or move about. Unquestionably, linseed meal is the best material for an ordinary poultice. Care should be taken to renew the poultice before it becomes cold.

A mustard poultice can be made in various ways. One way is to make a linseed poultice, and sprinkle a little mustard on the top. This is the best way, if the patient is a child. Over the surface of the poultice next the skin, put a piece of thin muslin. If a stronger poultice than this is required, it may be made by mixing two or three spoonfuls of mustard along with the linseed meal, or stronger still, mix a sufficient quantity of mustard with tepid or cold water to the consistence of a paste, according to the size of poultice you wish, and spread it on a piece of brown paper or rag, and over the surface. You may keep a mustard poultice on the patient fifteen, twenty, or thirty minutes; some skins are more sensitive than others, and when the part is red it is time to take the poultice off. Then sponge the skin quickly with tepid water, and lay a piece of cotton wool over the part.

Fomentations. To lessen inflammation and relieve pain, hot fomentations are often required, and are an excellent remedy; but remember what I have just said about the poultice applies equally to the fomentation. A cold dripping wet flannel will only add to the patient's misery and discomfort, while a thoroughly dry hot flannel is almost certain to give him great, immediate and lasting relief. Now let me explain to you then how a fomentation is to be made and applied. You want first of all boiling water, a piece of mackintosh or cotton wool, and a

large piece of coarse flannel, the coarser the better as it retains the heat longer, (a piece of old blanket or scouring flannel makes the best fomentation), a towel, and a basin. Now lay the towel over the basin in the way I show you, fold up the flannel and lay it on the towel. Now see that the water is boiling and pour it over the flannel. Then wring it in the towel as dry as you possibly can. Cover over with the mackintosh or cotton wool, and fasten it on with a flannel bandage. If you want to apply dry heat, heat salt, sand, or bran over the fire or in the oven, put it in a flannel bag and it will retain the heat for a long time. Hot bricks wrapped in flannel are very useful.

You are frequently enough required to apply cold to the head. To do so take one fold of cotton or linen rag, soak it in cold water, the colder the better, squeeze dry and apply it as rapidly as possible. Do not take a large piece of cloth folded several times, and keep squeezing it in your hand till it is quite hot and then put on. One fold of cloth, the thinner the better, dipped often in the cold water and rapidly applied gives great relief in headaches, for example.

If you can procure ice put a piece in the water. Ice is sometimes ordered to be kept constantly on the head; to keep it from melting, wrap it up in flannel, or put it in sawdust, and in a cool place. To break ice, do it in this way with a needle. Ice-bags can be bought for three or four shillings, or it may be put in a bladder and applied to the part, or a bag may be made of gutta percha and chloroform. By putting a little chloroform along the edges and folding them over, you can make a very useful bag for ice; the ice should be broken in small pieces before being put in the bag, and be removed as soon as it melts.

Nourishment is the third great factor of life, and food plays a most important part in the treatment of all illnesses, more especially fevers. The nurse must devote much of her attention to the subject of diet. You must observe carefully your patient's appetite, and attend carefully to the quantity of food and the effects of it. Give the nourishment regularly and at short intervals if the patient cannot take much at a time. Let me

beg you to be scrupulously clean with everything you prepare for the patient. If the doctor orders the patient a milk diet, your duty is to see that the patient gets that and nothing else. Be careful in this, as in all other instructions you get from the physician, to keep to it carefully. Milk is the most valuable article of diet in the sick-room. I may here remind you that about half-a-pint of milk is equal to about a quarter pound of beef in nutritive value. You must endeavour to get the milk good and to keep it sweet by keeping it in a cool place, and what is equally important, in a perfectly clean jug or basin. If you cannot manage to keep the milk sweet, then boil it at once when you get it and use it cold. Should the patient have sickness or diarrhœa, add one or two tablespoonsful of lime water to each tumblerful of milk. For any one very ill, and not able to sit up, use always a feeding-cup, such as I now show you. In feeding the patient with this cup, put your hand under the pillow and raise the pillow and the patient's head together, and take care you do it straight, so that the milk goes into his mouth and not down his neck, as is too often the case with careless nurses. The drinking-cup must be carefully cleaned by pulling a feather down the mouthpiece, and, when the vessel is not in use, it ought to be kept in clean cold water. Beef tea is not of so much intrinsic value as milk, but is useful as a stimulant as well. To make very strong essence of beef, you should do as follows :—You require a quarter of a pound of lean beef, take off all the fat, mince the beef very small, put it into a jar or pig covered with a lid or paper, place this in a pan of *boiling* water, the water to come half way up the jar ; boil for five or six hours, then pour off the beef tea, and give one teaspoonful or a half at a time. Ordinary good beef tea, such as you will now see made, is made by taking one pound of beef cut from the round, cut it into very small pieces, taking off all the fat, put it into a pan with a little salt and add a pint of cold water ; put it on the fire, and when it comes to boil stir till it is well mixed—say five minutes; then draw the pan to the side, and let it simmer for ten or twenty minutes, and it will be ready for use.

Egg Flip.—An excellent, quickly made, and most nourishing drink for invalids is to beat up an egg with a little sugar and boiling milk or water, stirring all the time.

If it can be at all managed, don't cook your patient's food in the sick room. He will be much more likely to take and enjoy it if he is not fussed seeing the process of cooking.

Medicine.—In giving sick people medicine there are three points you ought carefully to remember. 1, *Regularity;* 2, *Punctuality;* 3, *Exactitude.*

1. Give the medicine ordered by the doctor regularly, not sometimes one dose in the day and sometimes three, but just as often as you are told, and no oftener, every three hours or every four as the case may be.

2. Then be punctual; give it at the same time every day, ten o'clock, twelve o'clock, just as ordered.

3. Exactitude is a most important point. Always give the right medicine and the right dose. It has happened that people have been poisoned by getting either the wrong medicine or an overdose of the right.

Never allow a bottle of lotion for external use to stand beside a bottle of medicine to be taken internally. Keep them entirely separate, and let me beg your attention to this piece of advice,—keep all medicines in a place where children cannot by any possibility reach them. One further piece of advice, which is unfortunately but seldom attended to, is deserving of your attention, namely, after an illness has terminated either in recovery or death, empty out all the medicine bottles, and on no account retain any of them for future use. Spoons differ very much in size, and it is not wise to trust to them in measuring medicines. It is best to get a medicine glass or spoon, either of which can be got at a chemist's for a few pence.

To those of you who are entrusted with the administration of medicine to sick persons, the following hint will, I am sure, prove invaluable, namely, always read the label on the bottle before administering the medicine. By doing so you may probably save yourself from a lifelong reproach.

I now desire to address to you a few words on the nursing of children.

To nurse a sick child is a more difficult task than to nurse a grown-up person, who can tell you exactly how he feels and where his pains and aches are. Young children are utterly dependent on the kindness or cruelty of those about them, and very many suffer all their lives from the effects of the carelessness and ignorance of mothers and relatives. Frequently the only indication of a child being ill is its fretfulness. If the child is usually happy and good-tempered, and suddenly becomes cross and fretful, then you may be quite sure he is ill, and instead of scolding him, as is unfortunately too frequently the case, you ought to set yourselves to try and find out what is the matter. Many children want nothing but fresh air, proper food, warmth, and cleanliness, to enable them to grow up strong and healthy; and the want of one or other of these, is often the sole cause of illness. Children suffer from the same causes as grown up people, but much more quickly and seriously; nothing does them more harm than bad air. This is specially so at night; nothing can be worse than putting them to sleep in a close shut up room. Take care that you give them plenty of fresh air, and at the same time plenty of warmth. The disease which you all know as "rickets," and which is unfortunately very common amongst the poorer classes of our large cities, is mainly brought about by a want of pure air and light, as well as, no doubt, by insufficient food. Now, the two first of these requisites cost nothing, perhaps only some trouble and thought; and because these are not attended to our hospitals and dispensaries are crowded with children stunted in growth, with deformed chests, crooked backs and legs, and altogether in a miserable condition.

It is worth while to draw your attention to the first signs of this disease known as "rickets." Amongst the earliest indications of it is that the child perspires at night chiefly about the head, then the whole body seems to be tender and sore. He cries when touched or put down to walk. When you notice this, do not on any account let the child walk, give him as much fresh

air as possible, as much sun and light as you can (if possible, it is as well to take him to the country), clothe him warmly, and give as much good nourishing food as you can; three pints of milk daily if possible, and take your child to a hospital for advice. Unless taken in time, remedies are no use at all, and if neglected, he is sure to grow up ill-nourished and deformed.

There are some diseases of children, which come on so quickly that remedies come too late, and much valuable time is lost, if you wait till a doctor can be got. Croup is one of these; and as it most frequently comes on at night, it is of the utmost importance that you should know what to do at once, while waiting for the doctor to come. The first symptoms of croup are, that the child seems hot, fretful, and cries hoarsely. Young children are not often hoarse, unless they are in danger of having croup. The next sign is a peculiar ringing cough—the breathing becomes more and more laboured. When such is the case you should at once send for a doctor; but without waiting for his arrival put the child in a hot bath. Try to do this without alarming him, or making him scream, which will do harm. Lay a blanket over the bath or tub, on this blanket place the child, and let him gently down into the water. Do not burn him with too hot water, but carefully test the heat, not with your hand, which can bear much more than the child's tender skin, but the back of your hand or elbow.

After the bath, wrap him in a blanket, and take care he does not get a chill. Then give the child an emetic—one tea-spoonful of ipecacuanha wine every ten minutes until he vomits. Wring a sponge or flannel out of very hot water and place it to his throat, renewing it as soon as it cools—this is, let me tell you, a simple but effective remedy. When the attack of croup is severe, you may be ordered to keep the child in an atmosphere of steam. You can do this by making a tent over the bed with clothes-screens and a sheet or coverlet stretched over it.

Put a basin on each side of the bed, under the tent, and keep them constantly full of boiling water, emptying and refilling them alternately every quarter of an hour. Another method is

to keep a kettle constantly boiling on the fire. Bring the bed and tent near it; fix one end of a long india-rubber tube on the spout of the kettle, and bring the other end near the bed under the tent; the room ought to be kept well ventilated and moderately warm; you should feed the child on milk and beef-tea, and avoid giving him any solid food.

My time will not permit me to say more in regard to children at present, but before leaving the subject I should like to draw your attention to two things. First,—In a case where a child is seized with a fit, you should at once place him in a warm bath, as I have already described to you; give him a dose of purgative medicine such as castor-oil, and apply cold to the head. And in the second place, let me warn you against the use of soothing medicines and teething powders, which are too commonly given to young children. Nothing but harm can result from the use of such remedies. No sleeping draughts, nor any form of soothing syrups should ever be administered to a child except by the *direct* advice of a doctor.

Infectious Diseases.

Fevers are spoken of as "catching," infectious diseases, and about those you ought to know; not only how to nurse the person, but how to prevent others from catching it too. Scarlet fever, for instance, is highly infectious. The usual time for incubation is from twenty-four hours to three days; the rash is seen first on face, arms, and chest, like little red dots at first, and then becoming a red blush all over. It remains for three days, and gradually fades away. As soon as it disappears desquamation commences, that is, the skin begins to peel off. This is sometimes over in five days, and sometimes not for four or five weeks. In some cases the throat is much affected, and the child may be delirious for two or three days, or it may be very slight, a little, sick, slight sore throat, a little red blush, scarcely visible over the skin at night; the next morning, apparently, the child

is all right; you think nothing of it, and he runs about as usual. When this is the case, and desquamation begins, you may notice the child's eyelids swollen, and his face look puffy, breathing quick, the child seems very ill indeed, and if you do not at once send for a doctor, and use the proper means, he will most likely die. Many children die from this cause, getting cold during the stage of desquamation; while the peeling process is going on, the greatest care from cold requires to be taken to prevent the kidneys becoming affected on account of the deficient action of the skin, and dropsy following. If you should then notice the child's face puffy, and eyelids swollen, at once give him a hot bath, wrap him in blankets, put him in a warm bed with hot bottles, give him a hot drink, and try to get him to perspire freely; but while doing all this, send for a doctor, and be very careful to guard against draughts, a chill would be most dangerous.

A quick way of getting the patient to perspire is to use a vapour bath, such as the one you see here. Wrap the patient in a blanket; place an iron cage, stool or something that will keep up the bed-clothes and allow the hot steam to get to the patient over the foot of the bed; place the bath at the foot of the bed, with the tube passing into it; fill the boiler of the bath with boiling water; light the lamp and place it underneath. In ten or fifteen minutes you will probably find the patient perspiring freely; when this is the case remove the bath, and keep him very warm.

Infection in scarlet fever is conveyed by the flakes of skin shed when desquamating; those may be carried long distances, and be conveyed from one person to another by means of letters, books, clothes, &c. To nurse the patient with as little risk of infection to others in the house as possible, put him in a room by himself, at the top of the house, if possible. Take all unnecessary furniture out of the room; remove carpets, window curtains, and bed curtains. Hang a sheet steeped in carbolic acid, one to twenty parts water, over the door, and keep it always moist; before taking clothes, bed linen, &c., from the room; put them into a

pail or tub full of *boiling* water, or water and carbolic acid one to twenty or forty, for half an hour. Sanitas or chloralum may be used instead of the carbolic. When desquamating, if you rub the patient all over twice daily with camphorated oil, it will help greatly to prevent infection spreading. When the patient is convalescent give him warm baths with Condy's fluid, and wash with carbolic soap. When sweeping the room, burn the dust carefully, do not carry it out of the room. When nursing the patient, wear a washing dress, change it, and wash your hands in Condy's fluid and water, or some other disinfecting fluid before leaving the sick room. What has already been said about ventilation applies to fever patients and rooms quite as much as any other sick room. Cleanliness and fresh air are the best disinfectants.

To disinfect your room after the patient has left it is a very simple matter. Close every window and door; put some red cinders on a shovel, place this over a pail or iron-stand in the centre of the room, and over the cinders sprinkle 1lb. or so of powdered sulphur; let the room be kept closely shut up for six hours, then open doors and windows to air thoroughly. You may disinfect letters, clothes, etc., in the same way, by hanging them up in the sulphur fumes. It is always the safest plan to burn books and papers used by a scarlet fever patient.

Measles usually begins like a common cold; the rash appears on the fourth day or later, little round red spots running into patches. Keep the patient in a warm room and in bed until quite convalescent, guarding against draughts, as in measles there is danger of the lungs becoming affected, and if this happens the case becomes very serious. The diet should be very light, plenty of good milk, beef-tea, etc., until quite convalescent, then a little fish is always a good thing to begin with.

Typhoid Fever has several names—Enteric, Gastric, etc. When you have this fever in your house, you must suspect something wrong either with the drainage, water, milk, or it may be from the dirty, badly-ventilated state of your whole house. You should not rest satisfied until you find out the cause.

It is a fever that comes on very gradually, the patient can scarcely tell when he first began to feel ill. A chilly feeling, headache, pains in back and limbs, loss of appetite, sickness and diarrhœa are the usual symptoms. The patient does not often take to bed until the second week. The fever usually lasts from three to four weeks and then he should begin to mend. The feverishness gradually disappears. At this time the very greatest care and attention are required or a relapse will follow. No fever requires such watchfulness and care on the part of the nurse as to diet. The doctor's orders as to this must be rigidly carried out; a very slight indiscretion, such as eating hard biscuit, grapes, etc., has been known to cause perforation of the bowels and death. The usual diet is milk, three to four pints, given a tea-cupful at a time. Until allowed by the doctor give nothing but milk and do not allow the patient to leave his bed.

Infection is conveyed by the effluvia and emanations from the intestinal discharges of the patient. Those should be at once covered and got rid of, using disinfectants freely, carbolic powder or chloride of lime is best. Strict cleanliness of all utensils used for the patient should be observed, and for her own safety, the nurse must be careful not to inhale the effluvia from the motions of the patient. If strict cleanliness, good ventilation and a free use of disinfectants is observed, there is little danger of infection from typhoid fever.

Typhus Fever is caused by overcrowding, bad ventilation, a dirty condition of houses, clothes and people. It is a preventible disease. It comes on more suddenly and is more quickly over than typhoid, usually lasting fourteen to seventeen days. Relapses are not usual. Commonly it sets in suddenly with a shivering fit, headache, a feeling of languor and drowsiness, the skin hot and dry; as the fever goes on the patient lies in a stupor, quite indifferent to what is going on. The nurse must not only think, but act for him; he does not ask for nourishment, and can scarcely be induced to take it; his life depends on the nourishment being given regularly. Towards the end of the first week a rash

appears—small, dull, crimson, irregular spots, chiefly on the back and arms; the teeth and lips become covered with a brown crust called "Sordes." This must be cleaned with a piece of lemon, or rag dipped in lime-juice, rubbed over them. The lips and tongue often become cracked and very painful, and bleed occasionally; when this is the case rub a little vaseline ointment over them after cleaning off the sordes. *Bed sores* in all fevers must be carefully looked for, and the precautions I have already told you of, used.

The bed linen of fever patients should be changed very frequently; always provide the bed with a mackintosh and draw-sheet. If the head is not ordered to be shaved, always cut the hair quite close; it is best to do this, as the hair will come out afterwards. Frequent sponging of the body with tepid water and vinegar is very refreshing, taking care there is no exposure to cold. I have already stated how this may be done. On the careful nursing of fever patients, and extreme regularity in administering nourishment, depends in great measure the patient's life.

In the early stage of convalescence there is always a danger of the patient sinking from weakness and exhaustion; notice particularly any tendency to chill, and this specially in the early morning. Cover the patient with a well-warmed blanket, put a hot bottle in the bed, and give him a warm drink. When very weak the patient must be roused to take nourishment. If you neglect to do this, or think it a pity to disturb him, he may pass into a state of fatal collapse.

In typhus fever there is a peculiar odour from the patient's breath and skin, and it is by this that the contagion is conveyed; plenty of fresh air, strict regard to cleanliness, and sponging the patient all over frequently with warm water and carbolic lotion, or Condy's fluid. Attention to these points is the best safety against infection spreading. No one should ever go near a fever patient fasting.

About the fourteenth day the crisis may come very suddenly. Perhaps at night the patient may be very delirious and feverish;

towards morning he may fall asleep, and wake quite conscious, less feverish, skin moist, and a healthy expression returning to his face. During the early stage of convalescence he sleeps a great deal. The same precautions with regard to disinfecting room, clothes, patient, etc., that I have already told you of in speaking of scarlet fever, applies to *all* infectious or "catching" diseases.

SANITARY LAW AND ADMINISTRATION.

By WILLIAM C. SMITH, LL.B., Advocate.

THE sanitary law of Scotland comes from two sources,—first, what lawyers call the common law of nuisance: and second, a long series of statutes, all of them passed within the present century, some of which apply to the United Kingdom, and others to Scotland only. If I confine myself to-night to a consideration of these statutes, it is not because the common law is either antiquated or inefficient. It is a severe and stringent law, and it has quite recently been put in force. Only the other year a large manufactory of artificial manures near Inverness was stopped by order of the Court of Session, because the fumes of the sulphuric acid used in dissolving bones found their way into the adjoining mansion-house of Bunchrew and made some of the inmates sick. Still more recently, you may remember, the Shotts' Iron Company were interdicted from burning ironstone at their works near Penicuik, because the sulphurous smoke was injuring the plantations upon the estate of Glencorse. Now, in both these cases, the manufacturers had made considerable efforts to obviate the nuisance. They had erected new buildings and had used extraordinary precautions in the conduct of their business. To stop the works meant enormous loss or ruin. But the law of Scotland says:—"No one is entitled so to use his property as to cause injury to his neighbour's property, or to the health of his neighbour, or to render the occupation of his neighbour's property positively uncomfortable." And so these works were closed.

But the common law, if properly enforced, gives us not only pure air but pure water. You must have read in the newspapers how vigorously during the last few years the landed proprietors of Scotland have asserted their rights against the rapidly increasing pollution of rivers. The Esk, the Almond, the Whiteadder, have all been rescued from absolute destruction, and there is some ground for hoping that Gala Water may again become the pure and beautiful stream which inspired the noble song of Burns. Sometimes it is a paper mill, which is doing the mischief, sometimes a shale mine, sometimes a system of town drainage. The mill owners say, "how can we manufacture without a supply of water?" and the town's people say, "how can we live without drains?" The answer of the law of Scotland is that they must solve these difficulties for themselves. It is so stated by one of the greatest of Scottish Judges: "Riparian proprietors are entitled to use the water in any way they like, as it passes through their property, subject only to certain conditions. Now, these conditions are that they shall send down the water to their neighbours below, undiminished in quantity, and unimpaired in quality. It is impossible in the nature of things that a running stream should not receive in its course certain impurities as it passes along. But the meaning of the condition is that no unnecessary or artificial impurity shall be put into the stream, so as thereby to diminish the purity of the water as it passes to the proprietors or the inhabitants below." In fact, according to the theory of the law, all streams should be fit for drinking by man and beast, and for cooking and washing within dwelling houses, unless these primary and natural uses have been destroyed for a period of forty years. I am not going to speculate in what way towns and landed proprietors, and mill owners are to find a *modus vivendi* in the future. In all probability the mill owners will be compelled to store their own water in reservoirs, and towns will dispose of their sewage by one of the many schemes of irrigation. But I have said enough to show that as regards water as well as air, the common law of Scotland is not to be broken with impunity. But my object this evening is to explain

to you the leading principles of sanitary law, not as they affect private rights, and form the subject of disputes between private individuals, but as they have been incorporated into statutes, the administration of which has been committed to certain public bodies. And as it is with administration in Scotland, that we are mainly concerned, I shall say most about statutes which affect Scotland only. Before doing so, however, it is necessary to mention the more important Sanitary Acts which apply to England and Scotland alike.

First and foremost of these is the Factory and Workshop Act of 1878. I wish that time permitted me to sketch the gradual development of the Factory Laws: a movement with which the name of Lord Shaftesbury will for ever be associated. I wish I could point out how it has been found necessary in the public interest to put one trade after another under regulation, until now it is a little difficult to specify any workshop which is not a Factory: how clauses providing for education have been added to clauses providing for the safety of machinery; and how reasonable restrictions on the labour of the young have been added to sanitary provisions. Those sanitary provisions are either general, applying to all factories and workshops, or special, being restricted to certain trades. The general rules are these: (1) That every factory and workshop shall be kept in a cleanly state and free from effluvia arising from any drain or nuisance. (2) That there shall be no overcrowding injurious to health. (3) That the shop shall be ventilated so as to make harmless the gases, vapours, dust and other impurities which are generated in the course of the manufacture. The Act itself prescribes what means must be taken to ensure cleanliness. If the inside walls and ceilings, and passages and staircases, have been painted with oil or varnished once in every seven years, then you must wash them with hot water and soap once in every fourteen months: if not painted with oil or varnished, then you must limewash every fourteen months. I daresay a good many of us have been in workshops where the smells were not quite heavenly, and where there seemed to be either too many hands, or too little

ventilation. There is nobody on the spot to see that the Act is carried out: there is a limited staff of inspectors; and it is only now and then that the inspector can overtake each factory. And when he does come, he cannot see everything, and the proper complaints are not always made. I believe the number of inspectors ought to be considerably increased, but to whatever extent you multiply inspectors, it will always be the case that the Factory Act will not be fully carried out, unless the inspector is supported by an intelligent opinion among the workpeople themselves, and by a resolution to help in the inspection. If from a fear of offending the authorities, you won't speak out, you can't expect that what is wrong will be set right. On this subject I should like to mention the 68th section of the Act, which provides that anyone who attempts to prevent a child, a young person or a woman, from appearing before the inspector, is held to have committed an offence against the Act, and to be liable in a penalty of £5; and I should add, what is not so generally known, that under the 4th section of the Act the inspector is not merely entitled to point out any contravention of the Factory Act, but if he sees anything wrong—say with the supply of water—under the Public Health Act—he is bound to give notice of that to the local authority of the town or parish. I cannot leave these general rules without reminding you that a very serious liability is incurred by sending or admitting to employment a child or young person who is not fit for work. Wherever the age is less than sixteen, there must be a certificate after personal examination by a surgeon that he is satisfied with the evidence of age shown to him, and that the child is not incapacitated by disease or bodily infirmity for working daily for the number of hours allowed by law. That regulation may often seem a harsh one, when there are many mouths to feed at home and every shilling that comes in is counted. But I believe it to be just and necessary. Many children have been killed by attempting work beyond their powers. The infirm or diseased child may find some lighter work: if not, the parents must submit to the burden which they have placed upon themselves.

Among the regulations of special trades I can mention only two. There are certain shops, in which grinding, glazing or polishing is done upon a wheel, and dust is given off which is inhaled by the workers to an injurious extent. In such cases the inspector has power to order the use of a fan, or some other mechanical means to prevent the inhalation. Again, you know, that bakehouses have to begin work very early in the morning. I think I have seen their chimneys beginning to smoke between 4 and 5 A.M. That has led to a practice of bakers sleeping near the bakehouse. Now it is a contravention of the Factory Act to sleep in a room on the same level with the bakehouse, unless the room is effectually separated from the bakehouse by a partition from floor to ceiling, and unless there is an external glazed window of at least 9 superficial feet, of which $4\frac{1}{2}$ are made to open for ventilation.

There is one great class of industries, upon which the prosperity of the United Kingdom depends to a very large extent, and to which the Factory Acts do not apply. I mean the mining industries. Their development of late years has been very rapid. Take coal alone. In Scotland between the years 1871 and 1875 the annual output of coal rose from 15,438,000 to 18,597,000 tons, and 146 new collieries were opened. I do not say that all that increase was legitimate and healthy. In fact, a good deal of the enterprise of that period was carried on in the spirit of the gentleman who said, in 1873, that if he did not find coals, he would go on sinking to a place remarkable for its warm climate, and bring up cinders. But the coal trade lies at the very foundation of our manufacturing and commercial greatness, and therefore for the most selfish reasons, apart from motives of humanity, we are interested in the sanitary condition of our coal mines. Now that matter is at present regulated by two comprehensive Statutes: The Coal Mines Regulation Act of 1872, which applies, not only to coal, but to stratified ironstone, shale, and fire-clay; and The Metalliferous Mines Regulation Acts of 1872 and 1875, which apply to all other mines. Now, the grand principle of both these Acts is that neither women nor

children may work under ground, and that the employment of young lads is put under wholesome regulation. I think that may be truly described as a piece of sanitary law; for if children are to be stunted by premature exertion, and mothers are to wear themselves out by labour outside their homes, I don't see how you can expect either health or happiness in this world. But in the narrower sense of the term sanitary law has to do only with physical agents, and in this sense the most valuable provision of The Coal Mines Act is this, that no mine is to be worked unless every seam has two shafts or outlets in communication with it, with ten feet of natural strata between these shafts, and between them also a road four feet wide and three feet high; and unless there is at the mine ready and available for use some proper apparatus for raising and lowering workmen. But the law does not stop there. The main purpose of these shafts, as was shown by Prof. Maclagan in a simple experiment at the beginning of his course, is to produce ventilation. According to the General Rules made and published under the Act, in every mine an adequate amount of ventilation must be constantly produced, so as to dilute and render harmless all noxious gases in the working places and the travelling roads. And it is the law that every twelve or twenty-four hours, before any shift of workmen begin their work, some competent person appointed by the owner shall inspect that part of the mine with a safety-lamp, and make a true report on its condition. And under the same Rules the miners themselves have a most important power, for once a month they are entitled to appoint two of their own number to make a thorough inspection of the mine. Now, all that makes a great charter of safety and protection to the workmen, and yet you know how many sudden and terrible calamities occur at our mines, how many heart-rending scenes, how great an annual loss of life. Who does not know the desolation of that scene at the pit-mouth, with shattered buildings and wrecked machinery, and round about the crowd of weeping, silent, pale-faced women? In this, as in every other case, a good law must be well administered in order to succeed. Now, the Government Inspectors of Mines are men of

energy and devotion, but they have no time to make a suffieient number of inspeetions. In these eireumstanees one would expeet that the men themselves, who have the strongest interest in the matter, would do something for their own proteetion. Alas ! we know that the very opposite is the ease, and that many of these dreadful aeeidents are eaused by the reekless negligenee of the men themselves.

I think that, besides faetories and mines, there is only one other large class of works whieh have been plaeed under systematie regulation. These are the alkali works—works for the manufaeture of alkali, sulphate of soda, or sulphate of potash. The muriatic aeid gas whieh is evolved in such manufaetures is one of the most disagreeable and dangerous of the nuisanees of trade. You all know what volumes of poison some of these tall ehimneys used to pour into the surrounding atmosphere. For the last twenty years the alkali manufaeturers have been direeted under penalties to eondense their gas. By the Alkali Works Regulation Aet of 1881 the law has been extended to sulphurie and nitric aeid works, ehemieal manure works, gas liquor works, sulphate and muriate of ammonia works, and chlorine works, where bleaehing powder or liquor is made. You will not be surprised to hear that the law deals sharply with these trades. The muriatie aeid gas must be so eondensed that eaeh eubie foot of air, smoke, or gas eseaping from the works does not contain more than one-fifth of a grain of muriatie aeid ; and the aeid gases of sulphur and nitrogen must be so eondensed that the total aeidity per eubie foot does not exeeed what is equivalent to four grains of sulphurie anhydride, all these proportions being aseertained at a temperature of 30 degs. Fahr. and a barometrie pressure of 30 inehes. The owner of the work would apparently have to go through a difficult ehemieal investigation to know whether or not he is keeping the law ; but if he does break it, he is liable in a fine of £50 for the first offence, and £100 for the second. So far then as the law ean seeure it by inspeetors coming down from London, the air round these ehemieal works will be rendered pure. But this Aet further provides for the inspeetion

of (1) salt works, where the extraction of salt from brine is carried on, and (2) cement works, in which albuminous deposits are treated for the purpose of making cement. In these cases no precise standard of purity is laid down, but the owners are bound to use the best means which can be adopted at a reasonable expense for preventing the discharge of noxious or offensive gases or for making such gases harmless when discharged.

There is one other class of public buildings in the sanitary condition of which most of you must take a very warm interest: I mean the public schools. In these schools your children spend a great part of their lives at a time when the physical as well as the mental character is being formed. Do you imagine it is a small thing whether that time is spent under healthy or unhealthy conditions? Now, on this important matter the Education Act itself makes no express provision. But the object is accomplished indirectly. You know that the great majority of these schools have been built by the help of building grants from Government. According to the Education Code for Scotland, no building grant was ever made except for a site which was healthy and free from noise, and consisted of at least 1200 square yards. So much for construction, but that does not go very far. You also know that the great majority of these schools are to a large extent supported by annual grants from Government, which are given upon certain conditions of proficiency. Now, it is a leading condition of all these annual grants that the school premises must be well lighted, cleaned, warmed, drained, and ventilated, and properly furnished; that they must be supplied with suitable offices, and must contain sufficient accommodation for the average attendance of scholars—that is to say, 80 cubic feet of internal space and 8 square feet of area for every child. I have no doubt these regulations are generally observed, but it is one thing to have regulations and another thing to have them duly carried out. Her Majesty's inspectors are no doubt bound to report cases of defective ventilation and overcrowding. But their time and attention are very much occupied with the examination of the children, and I think it is the clear duty of parents to satisfy themselves that the health

of their children is receiving at school that protection which the law affords. Whether or not the regulations I have mentioned are sufficient in themselves I must leave the doctors to determine. But I know one fact which makes me greatly doubt their sufficiency. Five years ago there was an alarm about schoolroom poisoning in New York. The Medico-Legal Society of that city appointed a committee to confer with the school authorities upon that subject; and in the report of that committee I find it stated that five hours' daily school session requires 150 cubic feet as the smallest space compatible with efficient ventilation without dangerous exposure to draughts. So that in New York they think necessary for health almost double the amount of space which is mentioned in the Education Code.

Edinburgh is neither a manufacturing city nor a trading port; but we have all some friends upon the sea, and I think it may interest you to know that the sanitary law is not confined in its operations to the dry land, but extends a paternal care over our sailors on the mercantile marine. The main provisions on that subject are contained in "The Merchant Shipping Act of 1867." It is obvious that sailors on a voyage are very much at the mercy of the master. They cannot change their employment, they cannot even shift their lodgings. Lately we have had painful statements of the barbarities practised on apprentices. Accordingly the law has said that every place in a ship occupied by seamen or apprentices shall have a space of 72 cubic feet and 12 superficial feet for each seaman or apprentice, and the words "certified to accommodate ——" so many must be painted up over the door or hatchway. Further, the place must be securely constructed, properly lighted and ventilated, properly protected from weather and sea and from the distressing effluvia which are often caused by cargo or bilge water. But Jack Tar is not only entitled to a comfortable berth, he is also entitled to good food; and if either provisions or water are of bad quality and unfit for use, or even deficient in quantity, the master will be punished and the seaman will get compensation. The law even goes the length of making minute regulations on the subject of Jack's grog. Every

ship must carry a sufficient quantity of lime or lemon-juice as an anti-scorbutic, containing fifteen per cent. of proper or palatable proof spirits. Proper and palatable spirits are defined by Statute to be sound rum of a specific gravity from ·074 to ·920 or sound brandy of a specific gravity not less than ·920. I do not know what our teetotal friends will say to that. It is difficult for the human mind to imagine a British sailor who does not drink rum. Whether it is necessary or even beneficial I am quite unable to say. I saw the other day a statement by Lord Wolseley that for a long time back he had constantly discouraged the drinking of spirits in the army. Sailors, no doubt, stand in a different position and are exposed to other influences; and I suppose a man may take his anti-scorbutic "cold without" rum if he prefers. It is amusing, however, to observe that the Board of Trade actually take the trouble of mixing the grog for the seamen. They recommend that one ounce of the lime juice should be mixed with one ounce of sugar and at least half-a-pint of water and should be served out in time for dinner.

The consideration of lime-juice grog leads one naturally to the law relating to adulteration. If any of you have looked at the volumes of *Punch* about 1850 you must have been amused by the very lively description which is given there of the great adulteration scare. A report had just been published by the Lancet Analytical Sanitary Commission, which disclosed the existence on a large scale of systematic adulteration, and *Punch* represents Mr Briggs, the British paterfamilias, as using an enormous microscope at the breakfast table, and gradually discovering, to his horror, that the sugar, the coffee, the bread, the mustard—everything was composed of deadly poisons in various combinations, and that the water was swarming with animalculæ which, to his excited fancy, assumed the most repulsive forms. Mr Briggs looked forward to the immediate starvation of himself and family, but this calamity was averted by the passing of an Act in 1860. That Act imposed a penalty on every person who knowingly sold any article of food or drink mixed with any material or ingredient injurious to health. Some of the worst kinds of

adulteration were suppressed, but the Act broke down when it was applied to the case of mustard. At that time mustard was largely mixed with flour, and it was impossible to prove that flour is injurious to health. Another Act was therefore tried in 1872, but that Act also broke down in a prosecution of some Liverpool trades-people for selling butter mixed with fat, because it was impossible to prove that the tradesman knew that fat had been put into the butter in order to increase its weight and bulk. Accordingly, in 1875, the Sale of Food and Drugs Act was passed, of which the most interesting provision is that, under a penalty of £20, no person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality demanded. The way that Act is worked is this. Every town and county appoints a public analyst, and his duty is for a small fixed fee to analyse any sample which is brought to him by a member of the public. But only in some of the large towns is anybody appointed for the purpose of going round the shops and trying to discover cases of adulteration. Unfortunately, too, the Act is not compulsory, and it has not been much adopted in Scotland. Indeed it has been said that individual analysts, like Mr Cameron in Ireland, and Mr Stoddart in England, do more work in a single year than has been done in the whole of Scotland since 1875. You will therefore see that unless you yourselves take some interest in this matter, you are not likely to derive much benefit from the Act. And your interest is very great. There is no article of food on the purity of which your children's health depends so much as milk, and there is no article of food which is so easily and so much adulterated. I will give you an instance of that. The inhabitants of Dundee are said to spend £50,000 a year on milk. In March 1881 the Police Commissioners of Dundee caused a number of samples to be analysed and a number of milk dealers to be prosecuted. The result was that in the course of a week the value of the milk supplied to Dundee increased 25 per cent.; and it is therefore clear that for want of a public analyst Dundee had been losing £12,500 per annum. I am glad to say that

there is a very considerable improvement in the quality of the milk now sold in Scotland. Dairymen do not now put in chalk, gypsum, starch and animal brains, as they used to do, in order to make up the specific gravity. But they still take away the nourishing qualities of milk by skimming and adding improper quantities of water. One is not surprised to find water in buttermilk, because in cold weather they use hot water to bring up the temperature of the milk, before the churning begins. But the difficulty is to say how much water a dealer is entitled to put into pure milk. In a Glasgow case last year there was 18 per cent. of water according to the Somerset House standard, and the sheriff refused to convict the dealer. In the more famous Paisley case the year before, a man bought 4d. worth of cream, which was found to be diluted with 30 per cent. of skim milk. The dealer said there was a practice in the trade of selling two qualities of cream—one of good cream, at 2d. the Scotch gill, and another at 1d. the gill, which was largely sold to the working classes. In that case, and in another where the cream contained only 11 per cent. instead of the average 25 per cent. in weight of fat, the Court also refused to convict, one of the judges saying, "It is a great matter if the legislature is able to protect the public against unwholesome adulterations, fraudulent imitations, and deceitful disguises of bad quality; not effectually of course, but so far as possible in the existing moral and intellectual condition of dealers and customers in this country. Beyond this it seems desirable in the meantime that the richness of cream should, like the freshness of fish and the tenderness or fatness of beef, be left, as the prices are, to be arranged between buyer and seller." That is Lord Young's opinion; and therefore in the meantime you must look after your own interest in the buying of milk. I think it not improbable, however, that before long the judge will get some authoritative standard to go by from the government chemists. The law has dealt more effectually with butter. The manufacture of artificial butter has now become a great trade. Formerly, the farmer's wife put into the churn a pound or two of candle grease or hog's lard. But now there are

huge establishments at Hamburg and in America which turn out what the trade call "Jersey butter." A conviction was got in a very bad case of this kind, where the butter contained 60 per cent. of extraneous matter. I would rather not tell you what the extraneous matter was: I believe grease and brain matter. But since that case the new butter is sold as Butterine or Margarine.

One word about whisky. Some people will tell you, drink no whisky, you have yourself to blame if you get it bad. Perhaps you remember a story of the late Dean Ramsay's of a Highland drunkard, on whom the minister was trying to impress the fact that whisky was a very bad thing. "Aye, aye," said Donald, "it's a bad thing whisky, specially bad whisky." Whisky may be dangerous to some men, but adulterated whisky is poison to all men. There was a case at Greenock some years ago in which a man paid 2s. 7d. for a bottle labelled "Finest Old Highland Whisky." That was found to be mixed with sulphuric acid to such an extent as to be dangerous to health. About the same time thirty samples of whisky were taken in various parts of Glasgow—only two of these were pure, the others contained wood naphtha, oil of vitriol, turpentine, sulphate of copper, shellac, and chlorine water. These are terrible things for Donald to reflect upon. The practical conclusion of all this is that you should support the public analyst even if it costs you a little trouble.

I shall now explain the sanitary law which has been made exclusively for Scotland. There are, on this subject, two parallel lines of legislation. As you might expect, the necessity for doing something was first felt in the towns; and accordingly the earliest sanitary law is to be found in those general Police Acts which were passed in 1833, 1850, and 1862; one object of which was to give an efficient municipal organization to burghs without town councils, and to other populous places. At the present moment I am concerned only with the last of these which is generally known as the Lindsay Act, its author being Mr. Lindsay, then Provost of Leith. That Act has been adopted by a great many of the burghs which have Town Councils, and, although we sometimes

laugh at the "scenes" which take place in our Town Councils, there is no doubt they have spent a great deal of energy and business talent in the public service, and especially in carrying out the sanitary law. But the Act may also be adopted by any town or village which has at least 700 inhabitants. It then becomes a Police Burgh, governed by commissioners who are elected on the principle of representation. There are already between eighty and ninety such Police Burghs in Scotland. Now, to a great extent, the Lindsay Act is a sanitary act. It was passed to make more effectual provision for lighting, cleansing, paving, draining, supplying water and making other improvements: all of which contribute most powerfully to the general health of the inhabitants. I am not, however, going to explain to you the ordinary administration of a Police Burgh. I am not going to discuss whether electricity should be substituted for gas: whether wooden pavements are better than stone; or whether street refuse should be used as manure upon a municipal farm, or should be disposed of by cremation, as has been recently suggested by an engineer in London. What interests you chiefly, as members of a Health Society, is the fact, that the commissioners may, if they think fit, appoint a person of competent skill and experience to be Officer of Health. The duty of that officer is to ascertain the existence of disease, especially of epidemic and contagious diseases, and to point out any local causes likely to injure the health of the inhabitants, and the best means of checking or preventing the spread of such diseases. I need not say how greatly Edinburgh has benefited by the appointment of such an officer. You all know Dr. Littlejohn. Not content with discharging the duties assigned to him, he has created new duties for himself. When that much abused Statute, the Edinburgh Municipal Act of 1879 was being put together, he procured the insertion in it of a clause compelling the notification of infectious diseases. That clause has been efficiently worked, and it has saved the city from much disease and death. How much you may imagine when I tell you that in the year 1881 alone the authorities received 3,206 reports from 155 medical men, or upon an average, nearly nine reports of infectious disease on every day of the year. The

Lindsay Act gives to the community large powers of constructing public sewers and supplying water. But it also imposes very serious obligations on private owners. All private, as well as public sewers and drains must be provided with proper traps, or some other covering, or means of ventilation, and no new house can be built without a proper system of drainage, by communication either with a public sewer or a private cesspool. The owner of every house, or part of a house, occupied by a separate family, is bound to introduce water to it by a pipe of not less than half-inch bore; and he is bound to keep the sinks and soil pipes in the most complete repair, so as to prevent any leakage or effluvium. He is also bound three times a week to clean out any court, yard, or area belonging to the house. The owners of common stairs and passages are bound to provide the proper means of ventilation, and to whitewash or paint whenever required by the authorities; and the tenants are bound to wash and sweep the landing-place and the steps below, at least once in every week; and if there is an accumulation of filth inside a house, the authorities may enter and have it cleaned at the owner's expense. If you wish to build a church, a theatre, a school, or any house which is intended to hold large numbers of people, you must first satisfy the authorities by what method of construction you propose to supply a sufficient quantity of fresh air. No securities for internal ventilation are taken in the case of private houses. Such is a rough outline of the sanitary law contained in "The General Police Act" of 1862. You will understand, of course, that many of the larger burghs have got Police Acts of their own, which are stronger and better than the General Act. But it is now generally felt that, as matter of public convenience, the sanitary law should be uniform over all the country.

But side by side with the Police Acts, which were confined to such towns and larger villages as took the trouble to adopt them, there was a series of compulsory sanitary statutes which applied to the whole surface of the country. These were The Nuisances Removal and Diseases Prevention Acts of 1846, 1848, and 1856, and The Burials Act of 1855. Not much was done

under these early Nuisance Acts. They were meagre and limited in scope, and there was no proper central authority to stimulate and direct the local administration. The English Sanitary Act of 1866 was intended to apply to Scotland, but it proved to be utterly unworkable; and when in the summer and autumn of that year cholera was raging through several parishes and towns, the defective state of the law relating to public health was seen to be a very serious evil. The Board of Supervision addressed a strong remonstrance to the Lord Advocate; and the result was that in the following year he passed The Public Health Act, 1867, which was written by Sheriff Monro, and is now the Code of Public Health in Scotland. Now, who are the authorities responsible for the execution of that Act? The Central Authority is the Board of Supervision, a board created in 1845 for the administration of the Poor Law. The local authorities are the town councils and police commissioners in towns, and the parochial Boards in rural places. The powers of the Board of Supervision are very large, but not so large as they should be. They are constantly being applied to by parochial boards for advice and information about the working of the Act. They have a very small and hard working staff of inspecting officers, who visit and report upon sanitary defects; and they have one medical officer who makes special reports. They also receive complaints from individuals against local authorities, and wherever a local authority fails in doing their manifest duty, the Board will take proceedings against them. Montrose, Galashiels, Forfar, Pittenweem, all these places have been brought before the Court and compelled to provide proper schemes of drainage and water supply. The Board of Supervision also frame bye-laws for regulating the duties of the sanitary inspectors and medical officers appointed by the local authorities. They have to consider the sites and plans of hospitals, and the applications to Government for sanitary loans; and in various matters they act as a court of appeal on points of administration. All this work is done very well considering the means at the disposal of the Board; and it is done at very little public cost, for the board has eight members,

of whom only one receives a salary, the others being the Provosts of Edinburgh and Glasgow, three sheriffs, and one law officer of the Crown. As regards the local authorities, by which I mean the rural parishes and the smaller towns—for the large towns give no trouble in these matters—the first business of a local authority is to appoint a sanitary inspector. Unfortunately this is not compulsory, except in towns or villages having a population above 2000: so that many hundred parishes are under no obligation to make any such appointment. In other cases, the duty is often evaded, or it is formally discharged by the appointment of a scavenger or a constable at a salary of £5, or less. There ought to be, but in too many cases there is not, a medical officer as well. After appointing their inspector, the next duty of the local authority is to put down all nuisances which he reports. Now, under this Act a wide meaning has been given to the word "nuisance." Take the case of inhabited buildings. The inspector is entitled to object to any *insufficiency of size, any defect of structure or ventilation, any want of repair or proper drainage, provided that makes the house either injurious to the health of the inmates or unfit for human habitation or use.* The words are vague, but you see they go a long way beyond The General Police Act. When the matter is brought before him, the sheriff may condemn anything which is not fit for human habitation: "*Any house or part of a house so overcrowded as to be dangerous or injurious to the health of the inmates.*" I am afraid that is the normal condition of a great many dwellings of the poor. Bear in mind that either to own or to occupy such a house is an offence against the public law. Here is another important definition: "*Any well or other water supply used as a beverage or in the preparation of human food, the water of which is so tainted with impurities or otherwise unwholesome as to be injurious to the health of persons using it, or calculated to promote or aggravate epidemic disease.*" These words contain the history of epidemic disease in a great many of the smaller towns and larger villages in Scotland. As houses multiply, the old wells and cisterns become contaminated with sewage, and things go from bad to worse, until a new water supply is introduced. "*Any accumulation of deposits from*

ashpits, or manure from town or village laid nearer than fifty yards to a public road or a dwelling house." There is no provision of the Act, I think, which is more frequently violated than this. The language of the Act is plain, and the mischief aimed at is very great; but it is one of those cases in which familiarity breeds an ill-founded contempt, and people seem quite content to live on in close vicinity to large masses of decomposing matter. One word upon the question of smoke. In Edinburgh we do not suffer so much from that nuisance as manufacturing cities do. But I cannot help thinking that there is a good deal of avoidable smoke in Edinburgh; and with that smoke is connected the fog which has visited us with increasing frequency of late years. Now, excessive smoke is prohibited by the common law of Scotland. It is further prohibited by a special Act of Parliament in 1857, which was confined, however, to the larger towns. The Act of 1867 has extended this wholesome regulation to the country districts. Nothing is provided with regard to private chimneys, but every fireplace or furnace used for trade or manufacture is a nuisance wherever situated, if it does not as far as practicable consume its own smoke; and every chimney is a nuisance if it is sending forth smoke so as to be injurious to health. Many a pleasant village has had its atmosphere darkened, its gardens injured, and its beauty destroyed by the volumes of black smoke which a little careful stoking would have avoided. On this subject I will merely mention that in 1881 a Committee of the Greenock Police Board made a very interesting report, in which they strongly recommend the universal adoption of mechanical stokers for the furnaces of public works. I think, however, that hand-firing would do well enough if the human stokers took a little more care. Closely allied to the smoke question, is the question of offensive trades; I mean such trades as tanning, skinning, blood boiling, tallow melting, and many others. You cannot start a new establishment of that unsavoury description within 500 yards of any burgh or village, unless you get the consent in writing of the Local Authority. The Local Authority often give that consent too readily; and then the Board of Supervision may interfere. One last form of nuisance has been

brought under our notice very recently in this city: "*Any place of sepulture so situated, or so crowded with bodies, or otherwise so conducted as to be offensive or injurious to health.*" It was under this section that the St Cuthbert's Churchyard was closed in 1874. Most of you, probably, have read the report upon the cemeteries of Edinburgh, which was published last month. That report disclosed two important facts. In the first place, it seems that many of the graves are much too near the surface. Some are only a few inches down, and a large percentage are less than two feet from the surface. Now the rule prescribed by public authority in 1863 was, that "No coffin should be buried in any unwalled grave within four feet of the ordinary level of the ground." If that were necessary for public safety in 1863, it is much more so now, when there is greater crowding of such places. In fact, the best modern authorities say that six feet is the minimum depth. In the second place, these cemeteries are overcrowded. You know that fourteen years is the period of safety in such matters. Well, I find that in Warriston, Dalry, Echobank, and Rosebank, there have been 51,586 interments in the last fourteen years, or more than 1250 to the acre. I think that constitutes a real danger, and I will merely remind you that under the Burials Act of 1855 the authorities have full power to provide a new and suitable burying-ground. We do not need to wait for the competition of new Metropolitan Cemetery companies.

Apart from all these particular nuisances the Local Authority have large general powers for the prevention and mitigation of disease. They may provide hospitals and proper buildings for the public disinfection of clothes and bedding. They may enforce the registration and thorough cleansing of lodging houses. They are bound to take measures for the proper drainage of their district, laying the cost as far as possible, on those who take benefit from the sewers; and facilities are given for the introduction of a water supply sufficient for the domestic use of the inhabitants. Such is the sanitary law contained in the great Act of 1867.

Two other matters I must mention, which do not belong to the Public Health Act, but which are administered for the most part by the same authorities. The first of these is the prevention

of the pollution of rivers, to which I briefly alluded when speaking of the common law. If you are interested in the beauty and purity of any stream, I wish you to remember this important fact. In 1874 it was reported to Parliament by a Royal Commission that "in every case efficient remedies exist and are available, so that the present use of rivers and running waters for the purpose of carrying off the sewage of towns and populous places and the refuse arising from industrial processes and manufactures can be prevented without risk to the public health or serious injury to such processes or manufactures." Accordingly, in 1876, an Act was passed which prohibits putting into a stream three things—(1) any polluting solid refuse, or waste, or putrid solid matter; (2) any solid or liquid sewage matter; (3) any poisonous, noxious, or polluting liquid proceeding from any factory or manufacturing process. Unfortunately, as regards the second and third kinds of pollution, the Act goes on to say that, if you were polluting a stream in 1876 you may go on doing so, if you use the best practicable and reasonably available means for making the pollution harmless. The Act does not explain the distinction between pollution which is harmful and pollution which is harmless, and it has therefore been of little use. It is indeed much less stringent than the common law. But we need all the help that we can get to prevent our rivers from being turned into public drains. You may have noticed that under this Act the Town Council of Portobello have stopped the pollution of the Figgate by the Pow Burn.

The second matter is the Compulsory Vaccination Act of 1863. You are aware that every child must be vaccinated within six months after birth. To meet the case of pauper children, and to give facilities for gratuitous vaccination, as a preventive measure against small-pox, the Act directs each Local Authority to appoint a public vaccinator; and it also established a central institution for the collection and distribution of vaccine lymph. It is amazing how much indifference and even resistance there is to this beneficent Act among the poor. For the year ending 20th June 1881 the number of defaulters reported by the parochial registrars was 7939, while the total number of persons vaccinated by the public vaccinators was only 2129.

I have now sketched the law of public health, and I wish you to consider for a moment how far the authorities have succeeded in putting that law in force. In the first place, I must admit that there has been a rapid development of sanitation in this country. In the year 1870, three years after the passing of the Act of 1867, the total receipts of the sanitary authorities of Scotland under that Act amounted to only £13,477. In 1881 these receipts had risen to £236,130, including loans, being an increase of 1750 per cent. In 1870 there was spent on water supply the sum of £8791 ; in 1881 it had increased to £95,121. The total expenditure from 1867 to 1881 has amounted to £1,572,417, of which £199,028 has been expended on drainage, £522,982 upon water supply, and £246,541 upon hospital accommodation. These figures represent what is done under the Public Health Act, but not what is done under other statutes, more especially in towns. For instance, in the year ending 15th May 1881, there was raised in the Scottish burghs a general police assessment amounting to £319,993, a sewerage assessment amounting to £34,991, a water assessment of £267,954, an improvement rate of £45,625, and a burial rate of £15,716. The great bulk of that money is raised for, and applied to, purposes which are directly or indirectly sanitary ; and therefore I do not greatly overstate the case when I say that in the latest financial year, for which we have trustworthy figures, there was raised in Scotland by loan and assessment for sanitary purposes not much under £1,000,000. Now, when the population of Scotland is considered, that is no doubt a very considerable expenditure per head, but it would be a mistake to suppose that the law of public health is universally carried out in Scotland. It would be a truer thing to say that in the rural parishes it is not carried out at all. There are 882 parishes in Scotland, and in the year 1881 only 666 had done anything whatever under the Public Health Act. It has been said by a judge who has given much attention to these matters, that "in a very large number of parishes there has been complete neglect of administrative sanitary duties ; in very few, indeed, have these duties been properly and zealously discharged ;" and at a meeting of the British Medical

Association some years ago, at Inverness, it was stated that the Public Health Act is a dead letter in the north of Scotland. The same thing might be said of many parts of the Lowlands. Thus, in Berwickshire, only 17 parishes out of 32 have reached the stage of self-consciousness in this matter; in Dumfries, only 31 out of 43; and in Roxburgh, only 19 out of 32. A good deal of this apathy has arisen from the unfortunate idea, which has taken possession of many of the Parochial Boards, that the Public Health Act is a permissive act, that they are not bound to obey it and make themselves clean, but are entitled to remain dirty if they choose. I trust, if any of you have any influence in any part of the country, that you will help to destroy that mischievous delusion. The Public Health Act is universally binding on every Board and every individual in the country, and if they will not obey it, they may be compelled to do so. Then it is impossible to deny that the Parochial Boards are not very suitable authorities for public health. I do not refer to the political question whether they should be freely elected by the ratepayers. But I will tell you what the Board of Supervision said about them in 1867. "Many of them, altogether uninformed on such subjects, cannot appreciate the effects of filth and nuisance, of foul air and impure water in generating, propagating, and aggravating epidemic and endemic disease. The people generally are too much inclined to regard epidemic disease as a visitation which cannot by any precaution be averted; and they often object to be taxed for the removal of the most injurious sanitary defects, because they have all their lives been accustomed to them, and do not therefore regard them as evils. In such cases, the members of the local authority are sometimes unwilling to incur the odium of imposing the necessary rates, unless they can escape the consequent unpopularity, by shewing that they do so under legal compulsion. The men who are prepared to incur popular displeasure in order to do good to the people against their will are nowhere numerous, and when that displeasure may involve the loss of local dignity and emolument, are probably everywhere rare." The figures I have mentioned prove that the local authorities have shewn greater energy and public spirit during recent years, but it is certain that

the rural districts have suffered from their apathy. That is easily shewn by comparing the death rate in the rural districts with the death rate in the eight principal towns of Scotland during the decade 1869-78. These towns have vigorous and intelligent sanitary authorities; and many of them have extended sanitary powers under local acts. The death-rate in that period fell by twelve per cent. for the towns, but it rose by four per cent. for the country outside the towns. That is an emphatic commentary on a lax administration of the Public Health Act.

In conclusion let me say a word on proposed changes in sanitary law and administration. This formed the subject of a memorandum which in 1881 Lord Provost Ure of Glasgow sent to the other cities and large towns in Scotland. It was very much discussed in Glasgow in connection with the Police Bill for that City; and some of its provisions have been inserted in the general Police Bill, which the Lord Advocate is to introduce next session of Parliament. I have no doubt you will all agree to the main points of that memorandum. *First*, if overcrowding is ever to be got rid of, there must be more stringent and definite regulations with reference to the construction of houses and the free space round about them, so as to secure a free circulation of air. *Second*, the want of hospitals has led to innumerable evils, and therefore every district must have an hospital, and also proper arrangements for public washing and disinfection, including a reception house for healthy people, whose houses are being disinfected by the public authority. *Third*, the principle of the compulsory notification of disease, which has succeeded in Edinburgh, should be made universal. That is already proposed in Mr Hastings' Bill, which one Scottish member, Dr Farquharson, has promised to support. *Fourth*, you must have noticed that very often during the last few years sudden outbursts of enteric fever have been traced to the consumption of infected milk, and that the source of the contagion has generally been found in the unclean condition of some dairy-shop or farm. In Edinburgh our sanitary inspectors have power to examine such places, and the dairymen are bound to intimate to the medical officer the existence of infectious diseases on their premises, and the

sale of the milk can be prohibited. That power and duty should be extended to the whole of Scotland. At present there is nothing but an order of the Privy Council which has broken down in practice, and all recent experience shows that there must be some sanitary regulation of the milk trade. *Lastly*, you perhaps remember that, when I quoted some definitions of nuisance from the Public Health Act, these definitions generally ended with something about its being injurious to health. Sanitation has now become a science, and sanitarians say, I think justly, that if certain things are condemned as improper by sanitary science, local authorities should not be put to the trouble of proving in every case that the particular nuisance is injurious to health. So much for the amendment of the law. The administration also requires some change. In the first place, the central authority, the Board of Supervision, must be strengthened on the scientific side: otherwise we shall inevitably fall into the hands of the local Government Board in London. When that board was constituted some years ago, it was pointed out that it should have a chemist, an engineer, a statist, a lawyer and a doctor. Now the Board of Supervision lacks several of these elements. I hope these will be supplied, for I believe that in this, as in other matters, Scotland wishes to manage her own affairs. In the second place, the parish in Scotland is much too small a place to have a separate sanitary authority. In England the districts are much larger, and in consequence of that they not only get a stronger Board but are able to appoint a better class of inspectors, and to undertake more important sanitary works.

You will be glad to learn that I have finished. I have been speaking to you all night of rules and regulations. If I might be permitted to make a confession of my sanitary faith, it would be this:—Don't put your trust in rules and regulations. Study for yourselves the God-appointed laws of health; and when you have mastered their secrets, reverently obey them in your lives. Only in that way can you secure happiness at home and afford a good example to your neighbours.